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ABSTRACT

Two booklets, a guide and a handbook, comprise the grades 7-9 component of a series of guides for incorporating environmental education into the existing curriculum. The materials emphasize a multidisciplinary approach, use the concept of interdependence as an organizing theme, and offer suggestions for using the local community as a resource. Eight objectives, based on knowledge of systems, include understanding how population changes influence all other environmental issues, developing constructive attitudes toward one's surroundings, and comparing ways in which diverse human groups interact with their environment. The guide presents ideas and bibliographic suggestions for multidisciplinary study. For example, science classes could research major sources of pollutants, such as carbon monoxide, and report their effects on natural systems. English and art classes could study folk art of various cultures and note the ways that people use art to express their feelings about the world in terms of food sources, homes, gods, and landforms. The handbook contains four activity units in which students study effects of a nationwide airline strike and analyze the role of noise as a by-product of some systems and a necessary component of others. A simulation challenges students to identify and devise systems necessary for subsistence on a five-acre plot of land. (AV)

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Part C
7-9 Guide

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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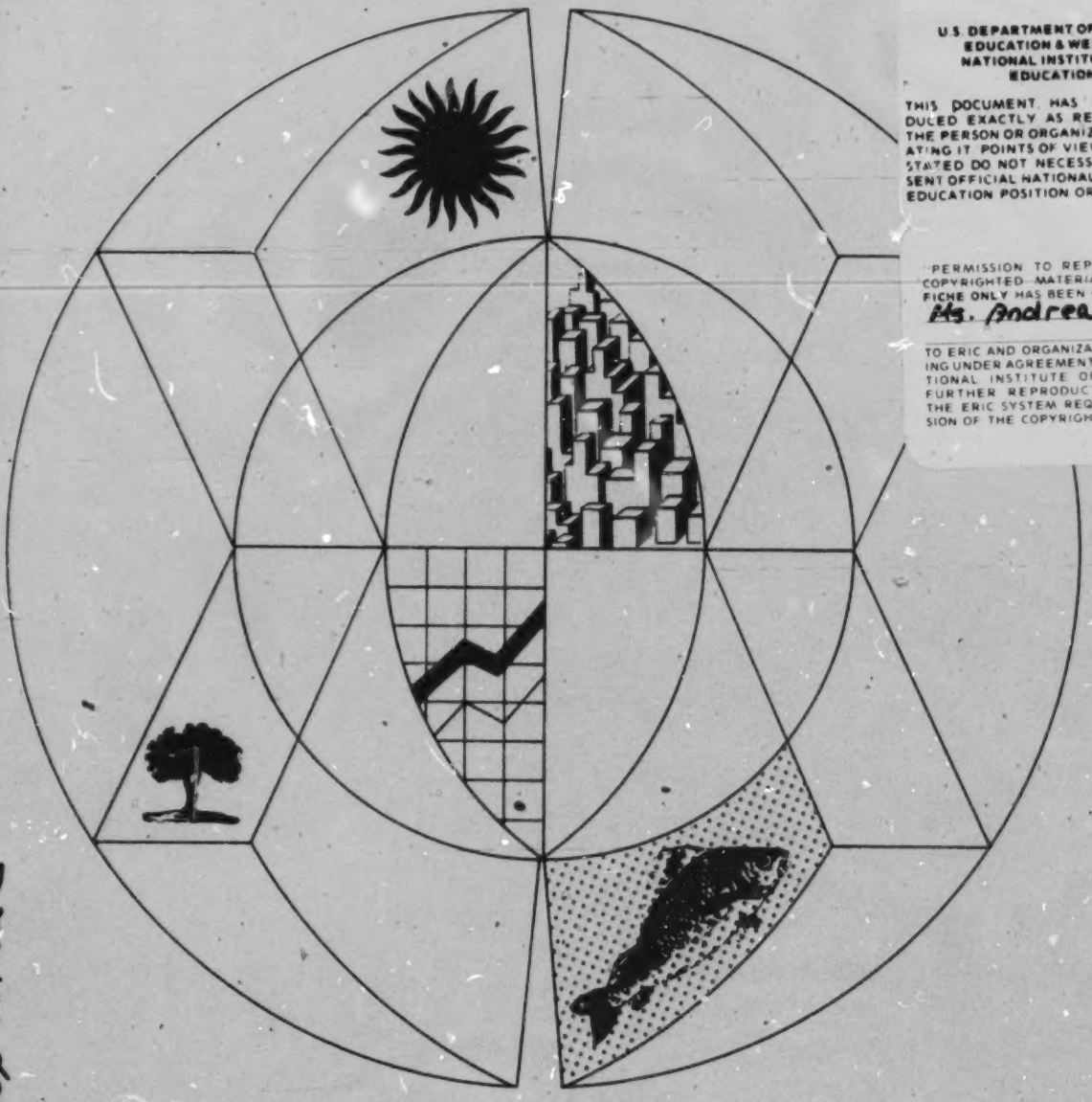

SP 009 822

Environmental Education Interdependence: A Concept Approach

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CENTER FOR GLOBAL PERSPECTIVES

DAVID C. KING

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Revised by Andrea B. Karls and John Boeschen

Center for Global Perspectives
218 E. 18th Street
New York, NY 10003

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ENVIRONMENTAL EDUCATION

INTERDEPENDENCE: A CONCEPT APPROACH

SUGGESTIONS FOR CURRICULUM DEVELOPMENT

PART C, 7-9

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ENVIRONMENTAL EDUCATION

INTERDEPENDENCE: A CONCEPT APPROACH

INTRODUCTION TO THE SERIES

PURPOSE

The purpose of this series of guides is to provide:

- strategies for incorporating environmental education into the existing curriculum (it is not a blueprint for a new course);
- a variety of ideas, questions to explore, and suggestions for lessons and activities which will allow teachers and curriculum developers to select those portions which best meet their particular needs;
- exemplary lessons -- which should prove useful in themselves and also offer ideas for your own curriculum development;
- an emphasis on multi-disciplinary approaches, since study of the environment is not limited to any single discipline or subject area;
- suggestions for using the local community as a resource for learning about population and other environmental concerns;
- an organizing theme around the concept of interdependence -- a conceptual lens which will provide students with a new way of organizing information and of looking at the world around them.

EDUCATION FOR ENVIRONMENTAL HEALTH

> Environmental education is not a new class to teach. Rather it is a fresh way to approach, consider and apply what you are already teaching in the classroom.[1]
>
> When we move into the areas of the social sciences, arts, and humanities, which once were considered unrelated, the outlines of a curriculum begin to emerge that not only will help children understand their interdependence with the natural world, but will help them develop the skills, attitudes, and knowledge necessary to understand and solve environmental problems.[2]

These two quotations stress the same point: environmental education is an integral part of the existing curriculum rather than a separate area of study. Perhaps that needs to be explained a little more fully.

Environmental education involves more than concern for the protection of wildlife or awareness that humans are poisoning the environment. Conservation and awareness are important, but they are only parts of a larger whole. In its fullest sense, environmental education involves *the individual's relationship to his or her total environment* -- and that includes the built environment as well as the natural. Every course we teach has something to do with how people relate to each other and to their world.

From every corner of the curriculum, then, there can emerge the skills, attitudes and information young people need for a creative approach to their environment. The major goal of environmental education is not to persuade students to launch or participate in anti-pollution campaigns. Much more basic is the objective of helping them learn to use all their senses to "reconnect" them with their natural and human-made surroundings. Each of us shapes and is shaped by the environment. The challenge to educators is to provide an education that will enable people to recognize areas of individual and

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[1] The American Institute of Architects, *Built Environment; a Teacher Introduction to Environmental Education*, 1975, p. 7.

[2] *Ekistics*, A Guide for the Development of an Interdisciplinary Environmental Education Curriculum, California State Department of Education, Sacramento, 1973, p. v.

group responsibility for their surroundings. They can then work intelligently toward structuring a healthy environment, instead of passively accepting whatever they find around them. Such a goal becomes increasingly vital as our world becomes more crowded and more urbanized.

INTERDEPENDENCE: THE ORGANIZING THEME

The idea of *interdependence* is deceptively simple. It means *mutual dependence* -- parts of the whole depending on each other. The term has become popular in the past few years as a key means of describing the nature of life on our planet. Such terms as Spaceship Earth or Global Village are more dramatic ways of stating the fact that we live in an increasingly interdependent world where the parts of the whole depend more and more on each other.

We constantly encounter interdependence in our daily lives and in the subjects we teach. When children learn about families or communities, they are learning about interdependent relationships. Similarly, the study of life in the ecosystem of a pond is a study of systems -- or interdependence -- as is the study or analysis of the functions of different aspects of government, the workings of an economy, or the interaction of characters in a play.

Although much of what we teach deals with interdependence, we have not really tried to help students understand the concept itself. Events are too often treated as isolated phenomena. Children are not trained to see a similarity between, say, what's involved in a unit on buying and selling and what happens in the microscopic life of a pond. One similarity is that both involve systems (interdependence).

This set of guides uses examples of systemness or interdependence to help students understand the concept. There is an underlying assumption: as young people become more familiar with the concept, they become better equipped to understand and cope with interdependence -- whether it involves their relations with others, with their environment, or with a subject being studied in school. Here is a simple example:

Without any major changes in curriculum, the child begins to see his or her world as being made up of an endless series of systems and subsystems. A tree is a system; so is the human body. A road map describes a road system; an equation describes a numbers system. A house is a system, so is the neighborhood, and the community is an even larger system composed of hundreds of subsystems. Through experience, the child becomes able to see the world through a systems lens; where appropriate, he or she puts on the systems spectacles and can then see how parts of a whole relate to each other, how the system

functions, what variables might interfere with its smooth operation, how it is similar to and different from other systems.

The concept thus becomes a tool to use for organizing information. With increased experience it can be applied to ever-more complex and sophisticated subject matter. An increase in population can be analyzed in terms of the many systems and subsystems involved. The student automatically knows what questions to ask about the consequences of this population change on space, food, light, other species, and so on. Students will develop the skills needed to minimize the negative results of systems change on their own lives. Finally, understanding of the concept enables the person to recognize the interactions between self and immediate surroundings and between immediate surroundings and the total environment of the planet itself.

This conceptual lens is not magic, nor does it provide everything people need to know to understand their relationship to their environment. But it does provide part of the equipment people need to attain that understanding and to respond to it in creative ways.

We said earlier that the idea of interdependence is deceptively simple. Obviously younger children will deal with it on less complicated levels, applying it to their familiar surroundings. However, when high school students explore the intricacies of global interdependence, they will be aware of the complexities, pressures, and tensions involved.

Robert G. Hanvey describes the complex nature of the subject:

> How does the world work? As a system. What does that mean? It means put aside simple notions of cause and effect. Things interact, in complex and surprising ways. "Effects" loop back and become "causes" which have "effects" which loop back...It means simply that events ramify -- unbelievably.[3]

Consider an example: The Organization of Petroleum Exporting Countries (OPEC) quadrupled the price of oil. This caused an increase in the price of petroleum-based fertilizers (effect), which in turn made it difficult (cause) for a farmer in India to produce a good crop yield (effect) since the new strains of grain developed by the Green Revolution, created (cause) to increase world food supply (effect).

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[3] Robert G. Hanvey, *An Attainable Global Perspective*, Center for War/Peace Studies, 1975.

rely heavily on those fertilizers. At the same time the oil price increase set off other chains -- increased inflation, the decision to build the Alaska Pipeline, lessening of aid to poor countries, and so on. A student with a solid background knowledge of interdependence has the tools to analyze and understand such a maze of interrelated events.

USING THE GUIDES

The curriculum guides are divided into grade clusters (K-3, 4-6, 7-9, 10-12). In each, we have presented a framework or outline describing ideas, suggestions, and activities for topics normally taught at these grade levels. The suggestions listed under each topic will indicate ways you can use your existing course work to develop better understandings of population and other environmental concerns through the concept of interdependence.

When you are planning a unit of study, refer to the relevant portions of the guide. Incorporate some of the activities or exploratory questions into your lesson plans. The guide, then, becomes something like a transparency that you place over your unit plans in order to see where you can add important elements of environmental education. You will also find that the sample lessons can be used for certain key topics, and as models for developing your own lessons.

While many of the topics listed in the guide emerge from social studies, we will frequently be crossing over into art, literature, science, and mathematics. This interdisciplinary approach will probably be easy for elementary-grade teachers to handle. In middle and upper grades, combining courses is more difficult, since there is often little coordination among teachers of different subject areas. We strongly urge team-teaching wherever possible, or at least a close working relationship among teachers. The students will gain tremendous benefits if there is a meshing of subject areas in dealing with environmental education. Faculty or inter-departmental meetings can be used to work out broad areas of coordination among the various subjects.

RESOURCES AND BIBLIOGRAPHIES

Even though most teachers are familiar with the basics of curriculum planning and development, they may find it desirable to review some of the current literature. Two extremely helpful reference books are *Education Index and Books in Print.* Look under subject areas such as "curriculum," "environmental education," or "conservation education." In addition, Educational Resources Information Center (ERIC) publishes a monthly index, *Research in Education* (RIE) which has an excellent collection of environmental education documents, including many produced by some interesting programs supported by HEW under Title III and the Environmental Education

Act of 1970. All three publications are found in most major libraries.

If you wish to develop materials especially for your local needs and resources, you should get in touch with the directors of model programs throughout the country. Their names, addresses, and telephone numbers are listed in *A Directory of Projects and Programs in Environmental Education for Secondary Schools* by John F. Desinger and Beverly Lee (ERIC, The Ohio State University Press, 400 Lincoln Tower, Columbus, Ohio 43210). Also see *Environment U.S.A.; A Guide to Agencies, People and Resources* (R.R. Bowker, P.O. Box 1807, Ann Arbor, Michigan 48106. 1974)

At the end of each unit in this Guide, you will find additional resources. They are by no means complete or comprehensive, but are intended to serve as general and supplemental readings. You may also discover that readings listed in one unit will be helpful in expanding material found in another unit of the Guide. We hope that the Guide, and the references, will provide you and your students with additional ideas for developing the curricula.

SUGGESTIONS FOR CURRICULUM DEVELOPMENT

ENVIRONMENTAL EDUCATION

GRADES 7-9

INTRODUCTION

The major topics in the following outline correspond to some of the broad subject areas common to the junior high grades -- the local community, U.S. or state history, the study of other cultures or world regions, the nature of the planet, and environmental problems. You will find marginal notations indicating ideas which apply to specific subject areas -- art, social studies, language arts, science, and so on. If you teach language arts, for example, you could examine those portions of the guide for suggestions on how to use your subject matter to develop important ideas about interdependence and environment.

Far more can be accomplished, however, if you can coordinate with teachers in other subject areas to create a multi-disciplinary approach to activities. This cooperative work isn't easy to work out, but the rewards will be well worth the effort. For one thing, students will gain valuable insights into the subjects. Learning about another culture, for example, becomes more enjoyable and more meaningful if students explore art, music, literature, language, and crafts as well as social, political, and economic systems. A second advantage of cooperative activity is that each contributing discipline provides some of the knowledge, skills and attitudes needed to understand interactions between humans and their environment. Whether the topic being studied is smog in Los Angeles, the heritage of native Americans, or modernization in Zambia, we should be dealing with philosophy, science, history, mathematics, and all aspects of the culture to achieve our educational goals.

OBJECTIVES

(Listed below are a series of broad objectives, at least one of which should be the focus of every lesson developed from the guide. Specific knowledge, skills, and attitude objectives can best be developed by the teachers or teaching teams in preparing individual units and lessons.)

1. To use a wide variety of activities to explore the natural and human-made (built) environment.

   Example: Students will combine math, science, literature, writing, photography, art, and social studies in exploring a local ecosystem.

2. To apply knowledge of *systems* and *interdependence* to analyze (a) population and other environmental issues; (b) the interaction of humans and their environment.

   Example: In analyzing a local environmental issue, students will identify interdependent relationships within the community and will be able to describe connections with global systems.

3. To recognize that population changes influence all other environmental issues.

   Example: Students will be able to predict ways in which an increase in human population density affects natural systems.

4. To understand that individual decisions influence population changes and that population changes, in turn, affect individual decisions.

   Example: Students can explain how an individual decision to buy a home in the suburbs affects population distribution; the growth of the suburbs then attracts more people.

5. To develop more constructive attitudes toward one's own surroundings.

   Example: Students will experiment with arranging their own living space in ways they find more satisfying.

6. To recognize that individuals can contribute to further environmental deterioration or to the creation of a healthier environment.

   Example: Given a decision to be made in the local community, the students will identify ways an individual might affect that decision.

7. To make comparisons of ways diverse human groups interact with their environment.

   Example: The class will make a comparative study of built environment in a variety of cultural settings.

8. To recognize that very real conflicts emerge over decisions involving environmental change.

   Example: Students can explain the advantages and disadvantages of setting aside land for the protection of an endangered species.

TOPIC AND IDEA OUTLINE

I. SYSTEMS: BEGINNING TO UNDERSTAND INTERDEPENDENCE

***Note:** Some of the definitional activities described in this section should be tried before proceeding with other sections of the guide.*

The basic idea of systems is quickly understood by junior high students -- the idea that parts of a whole work together. In fact, they should be ready to deal with the concept with increasing sophistication over this three-year period.

A. Introducing the Idea of Systems

GOALS

- To define "systems."
- To identify increasingly complex systems.
- To describe how parts of systems interact.

1. Ask the class for ideas about what the word *system* means. What are some examples?

   (They will probably suggest some systems they've already learned about -- circulatory systems, economic or political systems, etc.)

2. Ask a volunteer to look up the word in a dictionary. Write the basic definition on the board; compare this with their original ideas.

3. Provide a series of pictures or slides (about a dozen) that will challenge the class to identify increasingly complex systems and how the parts interact. Some samples:

   a. A bicycle. Ask: What are the parts of the system? What if one part doesn't work? (The whole system will malfunction or fail.)

   b. A tree. How does each part function to keep the plant alive?

   c. An automobile. You can introduce the idea of a variety of subsystems (electrical, fuel, transmission, etc.) making up a total system. Notice, too, a vehicle depends on other outside systems -- fuel supply, highway, traffic laws, etc.

   d. A person working with hand tools to make an object. Here there is an interaction among systems (human and tools), possibly to create a new system.

e. A small group -- like a meeting, a picnic, a sport. Ask the class how some human groups can be considered systems. (The parts must work together.) What can go wrong with a human system? (Someone fails to perform, difficulties over ideas, personalities, etc.)

B. Systems and Interdependence

GOALS

- To introduce the concept of interdependence.
- To define world events in terms of systems.

1. Introduce the word *interdependence* (or *mutual dependence)* as a term that describes how systems function.

2. Ask volunteers how parts of systems they've encountered are *interdependent*. (The parts depend on each other.)

3. Explain that systems and interdependence are important ways of understanding complex events in the world around us -- that some of their work in the next few weeks will involve analyzing a wide variety of systems and how their lives are influenced by them.

Begin immediately with lessons that will give students experience with these concepts as suggested in the rest of this outline.

ADDITIONAL RESOURCES

Patterns for Teaching Interdependence. Cathryn J. Long and David C. King. Center for Global Perspectives, 218 East 18th Street, New York, N.Y. 10003, 1975.

Interdependence, 7-9. David C. King. Center for Global Perspectives, 1975.

II. EXPLORING THE ENVIRONMENT

A. Ways of Knowing Your Environment

GOALS

- To trace the elements of the built and natural environments in the classroom.
- To view the classroom as a modifiable habitat.
- To explore the immediate environment through a variety of subjects.

The introduction of ideas about systems and interdependence will equip students with a new tool for analyzing the world around them. They will begin to discover and understand an infinite variety of interactions and relationships that they probably had not been aware of before. Simple ideas of cause and effect relationships will be replaced by a growing awareness of the complexity of human-environment interactions.

1. Explore the classroom as environment

   a. Point out that there is natural environment and environment created by humans (the *built* environment). The two interact. To explain that point:

      - Ask the students to identify the materials used in the built environment of the classroom.

      - What are the origins of objects made of wood, steel, plastic, etc.? Trace some items to their sources.

      - Clothing presents another area for discovery. Are the fibers natural (wool, cotton, linen), or human-made? Where do human-made cloths come from? (Primarily from petrochemicals -- oil and chemicals)

      - What are some of the systems involved in creating the built environment of your classroom? (Lumbering, mining, oil, transportation, research, marketing, manufacturing, agriculture, etc.) Students will see rather quickly that the connections are almost endless.

   b. How does the classroom depend on light from the sun?

      SCIENCE

      At first students will think there is little dependence, because of artificial lighting. But trace that lighting to its source. Have science class volunteers explain how the different sources of electricity depend on the sun (for example, even coal-generated electric plants depend on fossil fuels which represent life forms that trapped the sun's energy millions of years ago).

   c. Mark Terry, in *Teaching for Survival* (Ballantine Books, 1971), suggests the following as one line of investigation with the room's lighting:

      Electricity makes its appearance in the room at more or less convenient wall outlets. Without tearing apart the classroom it should be demonstrable that electricity is transported by wire, generally by copper wire, and that the wire in turn must be wrapped in some sort of insulating material. Stop. Already there is the discovery that this form of energy is inextricably related to the use of

certain materials, notably copper and plastics or rubber. This might be called "Branch No. 1," for it leads to investigation of the mining of copper and the world's supply of copper, both topics of great environmental interest. Also implicated is the entire synthetic plastics process, which has import both in its use of hydrocarbons derived from petrochemicals and in the problem of disposal of the durable synthetics. (p. 67)

Terry goes on to suggest four other "Branch" probes of a classroom's lighting. A complicating factor that has been discovered since *Teaching for Survival* was published is that the material used for insulation presents a serious cancer risk for workers processing it.

d. As you can see from the detail involved in exploring the lighting of the classroom, your immediate surroundings offer countless possibilities for probing, discovering, measuring, wondering.

e. Such explorations should help the students realize that their classroom is not an isolated shell where they spend a few hours a day. Rather it is built environment that is inextricably bound up with other environmental systems, both natural and human-made, and is related to the great complex of issues that make up our environmental concerns.

2. Other classroom explorations

SCIENCE

a. For reinforcement: Think of other interactions between classroom and natural environment.

(1) The air you breathe -- where does it come from, where does it go? How is it related to natural systems (e.g., plants)?

(2) Energy -- what uses energy? (Lights, heating, people.)

Where does the energy come from? (Food is one source.) How is the classroom use of energy involved with natural systems?

(3) Life-forms -- with magnifying glass and microscope what life can you discover in your room?

ART

b. The senses: Develop projects that will enable students to get the feeling of wood, fabrics, metal, clay, etc. -- something we tend to lose sight of after the elementary grades.

For example: Experiment with sensing objects when deprived of one of the 5 senses (blindfolded, hands

tied, etc.) and ask the students to describe their feelings.

3. If possible, experiment with the classroom as habitat.

ART

INDUSTRIAL ARTS

HOME ECONOMICS

a. Talk about desk arrangements, decorations, plants and anything else that would make your classroom environment more pleasant.

- Color, variety, and occasional changes are all important in becoming more aware of surroundings -- and recognizing that people can do creative things to shape their environments.

- Some class projects have involved bringing in new or additional furnishings, as well as decorative items. Even without going to such lengths, encourage suggestions for new arrangements, at least for special or group projects.

- Relate these discussions to the students' living space at home. Here, too, students face limits on arranging their surroundings. But, encourage them to experiment within those limits.

b. One creative approach is to think in terms of what a kindergarten classroom is like. There are lots of objects, activities, movements, things to explore, etc.

Are there ways for a junior high class to create a comparable mix in dealing with some of your main topics for the year?*

4. Discovering the immediate environment

Many science and social studies texts offer suggestions for studying such local subjects as the ecosystem of a field or pond, for field trips in an urban neighborhood, and for understanding the basic elements of our natural and built environment. You can add a few ingredients to these approaches to broaden the exploration, increasing interest and understanding. Here are some sample ideas:

MULTI-DISCIPLINARY

a. A course developed at the Jamesville DeWitt Middle School, in Jamesville, N.Y., used field work to combine science, English, social studies, and mathematics. The class was divided into 9 groups, each assigned specific activities such as:

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* For further discussion of the relevance of the kindergarten model to 7-9 levels, see *The Proposed California Humanities Framework,* Sacramento, 1975, p. 251f.

study of microscopic organisms

estimating heights of various plants and trees

study of larger animals

The collection of data required mathematics skills. English was involved in keeping notes and in writing creative prose or poetry accounts of how living things around a pond might view their environment. Social studies and reading were used for studying related information about the environment. All these approaches provide insights into the interdependence of life in an ecosystem.

b. In urban environments, multi-subject field studies might be built around examining *changes* in the environment (natural and built) in addition to the role of parks or open spaces (which might have limited relevance to the students' lives).

SCIENCE

For example, explore ways in which construction changes the environment, or how natural forces (from microbes to weathering) contribute to deterioration.

(1) *Photography* is an excellent tool for this age level.

PHOTOGRAPHY

- Learners can experiment with perceptions of their surroundings. The photographic work should be voluntary and fun, and will also develop skills.

- The students will rather quickly discover new ways of looking at the world around them, becoming more conscious of shapes, shading, light, etc. Comparisons with each other's works will reveal that each individual selects somewhat different elements to emphasize. This can lead to discussions of different ways of viewing the world around us, of what strikes the viewer as unusual or beautiful or symbolic.

- The technical side of photographic development is not only creative but can be used to demonstrate the workings of rather complex chemical systems.

(2) *Art* or *industrial arts* classes might present a display of different kinds of furniture designs used in homes and public buildings.

- Talk about the uses and aesthetics of furniture in the home.

- Arrange class or group trips to public buildings. Consider furnishings in both locations in terms of what the students find pleasing, comfortable, ugly, etc.

How do people decide what they prefer?

Why are furnishings an important aspect of environment?

What changes would the students make in the buildings visited?

How do these items fit into other parts of the environment?

What are the interactions between humans and built environment? (i.e., do we like or dislike surroundings? Why? What is there solely for function? For enjoyment? For both?)

- Invite an architect or designer to the class to talk about their opinions of built environments.

(3) Other ideas for studying urban environment, collecting data, and developing skills in chemical and biological analysis can be found in the materials of the Earth Science Curriculum Project, available from Houghton-Mifflin.

(4) For ideas about studying environmental problems in urban areas, see Section VI, pp. 32-33.

B. Studying the Community

GOALS

- To examine the built and natural environments of the local community.
- To determine the processes that change and influence the built environment.
- To observe the interdependence of the local and world environments.
- To project desired environmental changes into the future.

A basic part of understanding your town or city is to develop greater awareness of human-made environment and how it is related to natural systems. The students will also discover that environment changes over time, and will see how these changes affect people's lives.

The following ideas for multi-disciplinary approaches are suggestions for beginning. Teachers and teacher teams will undoubtedly develop additional activities.

1. Begin by conducting an inventory of built environment (for large urban or suburban areas, select a portion of the community).

   a. A large wall map can be used to record findings; math and mapping skills can be developed by having one group create the map.

MULTI-DISCI-PLINARY

   b. Buildings, roads, railroads, etc. are obvious items. Some may feel that parks and gardens are also built environment. The class can make its own judgments.

   c. Use separate coding to inventory elements of natural environment -- streams, lakes, woods, fields, hills, etc.

2. Explore the history of your community -- going back to prehistoric times if desired.

   a. How did the natural environment influence what was built and where it was built? (e.g. a mill near a power source; transportation routes, etc.)

   b. Using local resources (library, historical societies) make lists of changes that occurred over, say, the past century. As much as possible, base the study on art and photographs. Ask the class to give reasons for increases in the built environment. (Industrialization, population growth, new kinds of business.)

      What elements of built environment have disappeared and why? (Possibilities: barns, grain elevators, street cars, single family units replaced by apartments.)

3. Compare the present with the past. Which does the class prefer and why?

   a. The modern environment may seem more convenient, exciting, or comfortable. Ask if there is anything from a century ago they wish we still had. (Horses, open spaces, less congestion.)

   b. Using notebooks or tape recorders, have small groups interview older members of the community -- or invite them to visit the class. This will also develop interviewing skills.

      - Plan questions to learn their views of how the community has changed.

      - If their views differ from those of the students, which is likely, try to explore the reasons.

      - Older people may be able to describe the values of a different era, values your students may not be familiar with.

- Make special note of different ideas about interdependence or feelings about the environment. ("People were friendlier then -- everyone knew everyone else." Activities like travel or winter sports may have made people feel closer to the natural environment.)

4. Make a survey of how your community depends on other parts of the world environment. Divide the class into task groups. Use bulletin board or other displays to dramatize the findings.

SOCIAL STUDIES *ART*

a. Have one group choose a few items -- like TV sets, motorcycles, digital clocks, furniture -- and then find out where the manufacturer is located, the sources of raw materials, where parts are assembled, how transportation is involved.

b. A second group might choose a selection of foods -- then find the sources, where they were processed, how they arrived in your community.

c. A third group could check local industries and banks -- do they also operate outside your area? As with activities in exploring the classroom, the students will find that there are literally thousands of interactions connecting their lives with built and natural environment throughout the world.

5. Interdependence and change

a. Select one building from your inventory (e.g. a factory that makes something interesting to students). Find out who built it and why. How were others in the community affected? (Jobs, things to buy.) How has the building or its use changed over time? How has this involved others? (Business slow-down or expansion, pollution, providing tax money for the city.)

WRITING

- Encourage volunteers to write about the building, giving their impressions of it, or the building's own impressions of the changes it has witnessed.

- For other ideas about exploring your surroundings, see David Weitzman, *My Backyard History* (Little, Brown & Co., 1975).

SCIENCE *SOCIAL STUDIES*

b. Consider changes in the community -- proposed or in progress.

- Find similar examples in science or social studies texts (a new highway; office construction; new industry, etc.).

- What are the possible positive and negative effects of the change? How might it affect people's relationship to natural and/or built environment? (E.g. will it increase or decrease crowding? Will it preserve or destroy natural environment?)

- Does the class favor or oppose the change? Why?

- Are there alternatives available? Try to consider far-reaching consequences, such as strain on resources, how jobs will be affected, etc.

ENGLISH

c. Use stories, songs, and poems that deal with how people feel about change in our world. (Older people having trouble adjusting; moving to the city; the feeling that Americans must get back in touch with nature.)

A variety of such readings will help students probe their own feelings and consider new ways of responding to change. Some may want to use the local situation for their own creative writing.

6. Considering the future

a. From local newspapers find out about the current projections for your region -- how and why it will change over the next 20 or 30 years.*

b. Are there changes the students would *not* like to see?

- How will population changes alter the way people live?

- Is there likely to be more crowding, pollution, urban decay, etc.?

c. What projected changes would the class favor? (E.g., would they like to see more parks, open spaces, recreation facilities?)

d. In art classes, ask the students to draw or paint their views of what they would like to see the community look like 25 years from now.

- Have students bring in photographs of plans for future communities.

- City architects or local Chambers of Commerce may be able to show models or drawings of proposed changes.

e. Conclude the unit by talking about ways individuals and groups can influence change within their community. Or, to put it another way, can we plan the kind of environment we would like to have?

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* For additional ideas on dealing with population pressures and environmental pollution, see Section II and also Section VI.

C. Humans and the Biosphere

GOAL

- To study human/environmental interdependence through social studies and science.

Science and social studies texts are now likely to provide good materials for studying interactions between humans and the biosphere. Benefits are increased when the two subjects are combined. The careful approaches of science, stressing the continuing search for provable facts and the tentative nature of conclusions, provide good guidelines and help avoid oversimplified ideas about cause and effect relationships. The social sciences, on the other hand, emphasize the societal implications of environmental change and explore the kinds of human responses and actions which can contribute to a healthier environment. Here are two brief examples:

1. Chart the kinds of pollution in your community, including their sources (vehicles, factories, sewage, etc.).

   a. Biological explorations can help students analyze the complexities of interdependence, by investigating, for example, the water system and how it is influenced by human activities.

   b. Beginning chemistry can provide more detailed data. One middle grade text, for example, suggests charting air pollution in these categories: lead, sulfur, dioxide, carbon monoxide, smoke, and noise.*

   c. Social studies classes can deal with historical causes and explore some of the dilemmas that arise over environmental decisions. Examples:

      - Should DDT be used to stop a disease destroying trees near your community?

      - What are the advantages and disadvantages of trying to build mass transit systems?

      - Should laws be passed to reduce automobile usage?

2. Science experiments provide important knowledge and skills for dealing with environmental concerns on a local, national, or world-wide level.

   a. For example, experiments using jars or aquariums can be used to test the "carrying capacity" of an area, the factors that will contribute to population change.

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* See Norman Abraham, et al, *Interaction of Man and the Biosphere,* Rand McNally, 1970, p. 141f.

b. These findings provide a broader understanding which can be applied to population changes in the community, the nation, or the world.

ADDITIONAL RESOURCES

Nomadic Furniture. James Hennessey and Victor Papanek. Pantheon Books, 1973.

Our Man-Made Environment -- Book Seven. Group for Environmental Education (GEE), Cambridge, Mass.: MIT Press, 1970.

Citizens Make the Difference. Citizens' Advisory Committee on Environmental Quality, 1700 Pennsylvania Avenue, NW, Washington, D.C., 1973.

Man's Role in Changing the Face of the Earth. William L. Thomas, Jr. University of Chicago Press, 1956.

Man and the Ecosphere: Readings from the Scientific American. W. H. Freeman and Co., 1974.

III. EXPLORING SPACESHIP EARTH

A. Making Inventories of Spaceship Earth

GOALS

- To compare Earth with a spaceship.
- To study the forces which have created greater interdependence among the systems on Earth.
- To analyze how distant events affect local concerns.

1. Ask students to define the term *Spaceship Earth.* Does it have anything to do with them, or how they live, or what their futures might be?

   (If the Spaceship image has been overworked with your students, you might substitute the term *Global Village.*)

   a. Answers to the questions might be stated in the form of hypotheses to be tested.

   b. If you have students who are space buffs, have them describe a model of a spaceship.

      - What makes it a system?

- What are the life-support systems and how are they kept working?

- What is meant by a *closed* system? (No input from outside sources)

- Would there be a problem if the number of crew members were to increase steadily? How would other systems be affected?

- For a fascinating description of a spaceship approaching global proportions, suggest that some of your students read Arthur C. Clark's science fiction novel, *Rendezvous With Rama*. Ballantine Books, 1973.

c. Use such ideas, or readings, to establish the basic comparison of the planet and a spaceship -- a closed system with all life dependent on the same life-support systems.

You can also discuss, in broad terms, some of the dangers to earth systems -- overcrowding, overuse of resources, pollution of land, air, water.

2. One approach to making an inventory of spaceship conditions is to provide the class with examples which they can use to analyze how events in other parts of the world influence their lives.

a. For example, how could inflation in Japan influence their life-style (e.g., consider the costs of the many goods we now purchase from Japanese companies -- motorcycles, transitors, television sets, clothing, automobiles, stereos)?

b. As an assignment, have students go through three or four newspapers to cut out clippings that suggest ways in which life in your community is influenced by (1) events or decisions taking place elsewhere in the U.S.; (2) events or decisions taking place elsewhere in the world.

3. Inventories of resources -- divide the class into task groups.

a. Using a large wall map of the world, with political boundaries, conduct a nation-by-nation survey of the spaceship's food supply. Use current data (from Almanac, U.N. publications).

The use of colored lines or yarn on the map, connecting points of interaction, can be complicated, but can provide a dramatic visual image of the earth being tied together by strands of interdependence.

A grain shipment to the Soviet Union, for example, involves Midwestern farmers, Washington, railroads, shipping

ports in the South, Moscow, drought in the USSR, and the price of bread, flour, etc. in your community.

b. Another -- or alternative map -- would be to list the following data for 25-50 selected nations:

population 1975; projected population 2,000

calories per person daily

average personal income

gross national product (GNP)

grain imports or exports

(Useful data can be found in a special report of *Time*, November 11, 1974.)

c. Science classes could prepare reports on

SCIENCE

(1) The world's water system -- demonstrating how pollution in one area spreads.

(2) Air pollution -- here, too, a model or a demonstration of air pollution in one place can be shown to affect the total air system.

(3) The oceans as the last planetary frontier -- what's happening to them; their potential as source of food and minerals; the problems of pollution and control.

(4) Resources -- perhaps here a chart can show the vital materials for which we depend on other parts of the world.

(5) Energy -- e.g., the prospects of various fossil fuels.

- Some students might want to prepare reports on alternative energy sources; or, construct a project like a solar energy machine.

- Science and math could be used to consider coal as an alternative, with social studies classes focusing on the possible economic, ecological, health, and quality-of-life effects of increased coal production.

d. In all these probes, the students should be thinking of the planet as a single system. Discussion questions can be phrased in terms like:

- Does the Spaceship have adequate energy supplies? For how long?

- Is the food supply adequate?

- Can one compartment live in isolation from the rest of the craft's inhabitants? (That is, can one nation provide for the welfare of its citizens without depending on other parts of the planet?)

4. Your analysis of the planet as a whole should also include a historical study of the forces creating closer interdependence. For ideas on this topic see Section IV, Activities in U.S. (or State) History.

B. Population and Food: Can All the Passengers Be Fed?

GOALS

- To explore the problems associated with an expanding world population and adequate nutrition.
- To study current efforts in meeting world food needs.
- To propose solutions to projected world food shortages.

1. Examine the interdependence involved in world food distribution.

a. Find out how the food needs of your community are met.

SOCIAL STUDIES

- What other areas of the country do you depend on for food?
- What other areas of the world supply part of your food needs?
- Consider processing, transportation, and marketing as part of the interdependent webs involved in food supply.

HEALTH

b. Compare diets in different regions of the world.

SCIENCE

- What are the staple foods in various countries? (rice, wheat)
- How do diets in other countries (select five or six for comparison) compare with American diets?
- How much grain is required to produce the various kinds of meat Americans consume?
- What areas of the world are in serious trouble in respect to hunger and malnutrition? What percentage of the world's people have inadequate diets?

For teaching resources on such questions see Janye Millar Wood, *Focusing on Global Poverty and Development, A Resource Guide*

For Educators, Overseas Development Council, 1717 Massachusetts Ave., N.W., Washington D.C. 20036, 1974.

2. Consider present conditions and future projections

   a. How much food can the world's people produce?

      (In researching this question, students are likely to find wide variation in published estimates.)

   b. Have the students -- or task groups -- try to determine:

      - the amount of acreage available world-wide for food production.

SCIENCE

      - How much of it is currently used? How is it used? (grazing, grain, etc.)

      - How could more land be cultivated? What is the optimum?

      - Will the effort to produce more food have an effect on how we live? (Invite guesses or hypotheses -- later study will enable the class to modify these ideas.)

   c. How can an event in one part of the world influence the already shaky world food situation? Have students explore the impact of the following events, using the *Reader's Guide to Periodical Literature:*

      - OPEC nations quintupled the price of oil between 1973 and 1975. (Note: this affected the price of chemical-based fertilizers, fuel for farm machinery and irrigation pumps.)

      - The U.S. had a record grain harvest in 1975. (How much grain does the U.S. export?)

      - There are suggestions that the climate south of the Sahara (the Sahel) is becoming drier. How has this worsened the food crisis there? What will happen if there is another serious drought there?

      - What is the Green Revolution? What successes have resulted? What problems have been encountered? How was the Green Revolution affected by the increased price of oil? (The new strains require large amounts of chemical fertilizer.)

   d. Explore varying viewpoints on how population growth will influence life on the planet over the next 25 to 50 years. Use outside readings for research. [*Options*, a booklet produced by the Population Reference Bureau, 1755 Massachusetts Avenue, N.W., Washington D.C. 20036, based on the official report of

the Commission on Population Growth and the American Future, has good teaching suggestions, some suitable for these grade levels.]

(1) Why do some experts predict widespread famine before the end of the century?

(2) In what ways can technology help provide solutions to the gap between population growth and food supply?

(3) Why do many national leaders feel that population control is not the answer?

(4) What efforts are currently being made to improve food supplies and distribution? (Consider especially the work of the U.N. agencies.)

e. Conclude by asking students how they feel about the problem -- which viewpoints do they agree with most and why? How do they feel about the role of the U.S.? Are Americans doing enough to help others? Should Americans try to consume less? Why or why not? Does it make any difference what each of us does -- that is, are we involved in the problem and can we affect it?

This last question is difficult. The class should see by now that we are involved because of the interdependent nature of life on our planet. At the same time, what *one* person does makes little difference. It is what we do as a collection of people that makes a difference. How, then can the students act in ways that will make a positive contribution? Encourage them to explore group projects. Suppose they raised $50 and contributed it to an organization like CARE. Find out what that contribution could achieve, (organizations will supply specific details of what each dollar will do.) This kind of group activity can be particularly important in helping students overcome the feeling that problems are simply too massive to deal with; a single fund-raising project can create positive feelings that individual acts do matter.

C. The Oceans

GOALS

- To study the problems related to the mining and fishing of the oceans.
- To propose solutions to problems associated with increased use of the oceans.

Units on the oceans for the middle-grades have both advantages and disadvantages. On the positive side, few subjects reveal more clearly the

increasing interdependence of life on our planet, particularly in regard to population and other environmental issues. The disadvantage of the topic is that many of the specific problems regarding exploitation and preservation of ocean resources are very complex. In addition, few science or social studies texts offer extended treatment of the subject, so you are likely to have to construct your own lessons using outside readings and A-V materials. Here are a few suggestions.

1. Divide the class into committees -- some work can be carried out in science courses; some in social studies. You might have the class simulate the work of the Law of the Sea Conferences. These international conferences (most recently held in Caracas in 1974, Geneva in 1975 and New York in August, 1976) are attempting to establish rules regarding fishing and mineral rights, territorial waters, protection of endangered species, and other matters. Committees could be used to make reports and recommendations to the class. The class as a whole could then try to reach agreement on some of the major issues. (See "The Control of the Seas and the Ocean Resources Game" in *Intercom* #78.)

SCIENCE

SOCIAL STUDIES

2. Topics to explore through committee work:

SCIENCE

a. What are the sources of ocean pollution and how serious is the problem?

SOCIAL STUDIES

- Consider sources such as oil spills and ocean oil dumping; urban waste systems; chemical run-off from farming and manufacturing.
- How has ocean life been affected -- especially in off-shore areas?
- How does ocean pollution demonstrate the interdependence of life on the planet?
- Have any laws been passed to help correct the dangers?

b. How valuable are the oceans as a source of food?

- Which are the leading fishing nations? How important is fish to national diets?
- Why do few developing nations have important fishing industries?
- Who owns the food supply of the oceans? (Different nations claim exclusive rights for different distances. Most claim a 12-mile limit, some a 200-mile limit.)
- Should all nations have a right to food from the sea? How could this be done?

c. How important are the oceans as sources of minerals?

- What are the nodules that contain valuable minerals? (Small manganese nodules, about the size of a potato, are rich in copper and nickel, and could be mined fairly easily.)

- Who should be allowed to mine the ocean -- the nations with the technology to do so or should all nations share?

3. On the basis of committee reports, have the class make proposals on three broad issues:

   a. Protecting the oceans from pollution and overuse.

   b. Controlling fishing rights.

   c. Controlling mineral rights.

4. Some questions for discussion.

   a. Why must the nations of the world reach agreement on these questions? What will happen if no Law of the Sea is created? Why is there such difficulty in reaching agreement?

   b. How do each of the issues show the interdependence of the world's nations? Is this interdependence easy to live with? (Students should understand that having to cooperate is often not pleasant. Many people would rather have each nation make its own decisions -- in which case the strongest would make the rules, because it could enforce them.)

   c. How could a single nation help solve the problems? (A fishing nation might, for example, propose sharing its harvest with the poor nations of the world. The students will easily see that such a unilateral step is not likely.)

   d. How are the ocean issues related to the problem of the gap between population growth and food? (If we manage the ocean's resources more wisely, we could help ease the problem of world hunger.)

ADDITIONAL RESOURCES

This Hungary World. Elizabeth S. Helfman. Lothrop, Lee & Shepard, 1970.

Wonderful World of the Sea. James Fisher. Doubleday, 1970.

Plants That Feed the World. Rose E. Frisch. Van Nostrand, 1966.

Energy for Survival. Wilson Clark. Anchor Press/Doubleday, 1975.

The Sea. Life Nature Library. Time-Life, 1968.

The Sea: Teacher's Guide and Resource Manual. Silver Burdett Reading and Research Program, 1964.

Operating Manual for Spaceship Earth. R. Buckminster Fuller. Pocket Books, 1970.

Population. Valerie K. Oppenheimer. Headline series, No. 206. Foreign Policy Association, June 1971.

IV. ACTIVITIES IN U.S. (OR STATE) HISTORY

A. Environmental Themes in Pre-Columbian History

GOALS

- To use a wide variety of activities to explore environmental changes in U.S. history.
- To develop hypotheses explaining why early humans interacted with the North American environment as they did.

You can develop interesting lessons on environmental changes in what is now the U.S., and how those changes influenced life forms. Much of the work can be achieved by giving individual or group assignments for class reports. Some sample topics:

1. Plate tectonics (a construction showing shifts in the earth's crust) can be explored from a variety of perspectives.

SCIENCE *MATH*

a. For example, a group of students could build a table model to demonstrate the "calving" (breaking up) of continents. The work can be related to mathematics topics such as working with grid patterns.

b. Back issues of *The Smithsonian* and *Scientific American* could be used to create a map display of different stages of continent formation.

c. Future projections could be explored. For example, scientists report that Los Angeles is gradually drifting north and will eventually move past San Francisco.

Such activities will impress upon the class the idea that the earth changes constantly and in ways that are beyond the control of humans.

2. Find out what your region of the country was like in the past and what changes have taken place (glaciers, mountain formation, changes in climates, vegetation, etc.).

a. What evidence can you find of regional changes? (Mountains, lakes, etc.)

b. Your study should include ways in which environmental changes influenced changes in plant and animal life.

c. Some students could report on archeological evidence of the prehistoric horse -- how it changed, what factors may have led to its extinction.

d. If possible, arrange a field trip to explore fossil deposits in your area.

ENGLISH

3. Through literature and history, explore some of the theories about how humans first came to this hemisphere. While the Bering land bridge is the most widely accepted theory, the work of Heyerdahl and others provide good reading and will arouse curiosity.

4. The interactions of Indians and their environment. Group work is suggested here so that the class will learn about a variety of societies and environmental settings.

SOCIAL STUDIES

a. Groups can report on the cultures of specific tribes and how each adapted to the environment.

- What did the area offer and how did people make use of what nature provided?

- Did other groups in the same or similar settings develop different patterns?

- How did change influence their lives? Consider, for example, how Plains Indians' ideas of wealth, their methods of hunting and warfare, and their attitudes toward interactions with environment were changed by the introduction of the horse.

  Relate this aspect of the study to life today -- ask the class to consider what new conditions people have had to adjust to in this century.

- How were religious practices related to adaptation to the environment? (E.g., what objects in nature were considered God-like and why?)

ART

b. Art classes could be used to develop demonstrations of handicrafts (baskets, jewelry, tools, weapons) -- or to create diaramas of village life.

HOME ECONOMICS

c. Prepare reports on materials used for clothing, shelter, and food. What kind of foods did a particular group prepare? Demonstrations of food processing and preparation will spark interest. The variety of activities can help students gain a feeling of how people dealt with daily concerns. Comparisons among Indian societies will also contribute to an appreciation of cultural diversity.

B. Colonists and Their Environment

GOALS

- To discern the reasons for the colonials' attempts at changing the environment.
- To interpret how the colonials, through their arts and crafts, saw themselves in the new world.

1. A major topic to consider in studying the development of the colonies is how people were changing the environment.

   a. Why did the colonists create greater changes in the environment than the Indians had? Challenge the class to look for different answers to this question.

SOCIAL STUDIES

   (A more advanced technology is one answer. Also, colonists established large towns, concentrating more people in a small area. Total population is also a factor. By 1750 there were more settlers on the Eastern seaboard than there were Indians on the entire continent.)

   b. How did the arrival of colonists change the Indians' relationship to their environment? (They lost land, lost their freedom to roam, were gradually pushed elsewhere, game became more scarce, etc.)

2. Consider the life of the colonists in terms of their interactions with the natural environment. For example:

   a. With a shop teacher, have some students build household objects using the kinds of tools and materials colonists used. Some of the techniques and special devices (e.g., "tree nails") could be demonstrated to the entire class. (For tool description and designs for simple objects, see John Shea, *Colonial Furniture Making for Everybody*. Van Nostrand, 1964.)

INDUSTRIAL ARTS

   - This activity could be combined with a museum tour or small-group visits to an antique shop. With pre-arrangement, a knowledgeable dealer can point out intricate workmanship such as scrolls, dovetailing, dadoes, etc.

   - Use the activity to talk about the relationship of the craftsman to his materials and tools. Why would there be a different feeling about transforming a log into a table than there is in using power tools on prepared lumber?

   b. Many early itinerant artists were sign painters. They did landscapes and portraits for extra money. Art students could study the basic techniques and explain or demonstrate why

ART

ENGLISH early American art is "primitive" (lack of knowledge about perspective, etc.). (A good source is Lipman and Winchester, *The Flowering of American Folk Art*, Viking, 1974.)

- This could be combined with a creative writing activity about what an itinerant artist sees while traveling through colonial America. Journals and paintings provide good sources for the kind of detail noted and what this indicates about the relationship of the settlers to their environment.

c. Legends, folk tales and regional songs can also be exciting ways of discovering how people saw themselves in this new world.

ENGLISH

MUSIC

What did people seem to be trying to say about themselves, their lives, nature, work, etc.? Take note of expressions about the growth of humans' power over nature -- the desire to tame the wilderness -- and the notion that there was an endless frontier that always offered new opportunities.

d. Let your students imagine they are colonists. Have them develop strategies for surviving on their own in new surroundings (primitive at best). Discuss the most efficient way to live within the balance of nature (for additional ideas on this theme, see *Intercom* #83).

C. Changing Relationships: The Industrial Revolution

GOALS

- To observe ways in which industrialization has altered the interaction between humans and their environment.
- To view industrialization as creating ever-increasingly complex patterns of interdependence.

Before the age of machines, Americans had done much to change the environment of the New World -- clearing forests, farming, building towns and cities. The Industrial Revolution accelerated the pace of change. It changed the way people lived and worked, and it upset the equilibrium between humans and the natural environment. Machines gave humans enormous new power to change the natural environment, to create more built environment; the desire for machine-produced goods created tremendous demand for new materials, energy, manufacturing facilities, transportation, advertising and marketing.

Here are some ways to emphasize the changing relationship of humans and environment:

1. How did working conditions indicate changed interaction between people and environment?

SOCIAL STUDIES

a. Study a variety of pictures of industrial life and work in the 19th century -- textile mills, coal mines, tenement housing, etc. Compare these with earlier pictures of craft shops or nearly self-sufficient farm families. Ask the class to point out

- how the environment of workers has changed;

- indications of contact with natural environment.

b. Pictures can be combined with text accounts or documents describing how industry was changing life.

- What comforts and conveniences were being created that made adaptation to the environment easier? (E.g., farming became mechanized; interior heating and plumbing plus a growing number of household utensils made daily household tasks easier; new forms of transportation gave greater mobility; communications were bringing people into closer contact; etc.)

- Ask some students to write accounts of a day in the life of a factory worker, miner, or sweatshop worker.

2. Use art and literature to study changing ideas about progress and about nature.

ART

ENGLISH

a. Compare the writings of industrial leaders (Carnegie, Rockefeller, etc.) with those of earlier frontiersmen (Daniel Boone, Davy Crockett, etc.). Students will note that the journals of men like Boone showed an awe of nature and a feeling of closeness to the earth not unlike that of Indians. Later writers viewed nature in terms of potential resources and wilderness to be conquered. Thoreau provides a good example of someone who wrote about this transition of values with great dismay. (You might read to the class portions of *Walden or Life in the Maine Woods.)*

b. Compare artistic representations of life in the 19th century. The class should see that by the late 1800's some artists began to romanticize the remaining wilderness and began painting scenes of the grandeur of the western U.S. rather than concentrating on railroad building, steamboats, and the growth of cities.

c. Some readings, too, should indicate that a few Americans (John Muir and others) were trying to warn people about the consequences of the devastation of the natural environment.

SOCIAL STUDIES

d. Theodore Roosevelt and the Progressive Movement can be considered in terms of their attempts to check unlimited and unplanned growth.

- Land was set aside for wilderness and national park areas.

- Laws were passed to undo some of the harm created by rapid industrialization -- e.g., child labor laws, the Pure Food and Drug Act.

- States and cities attempted to create more parks, open spaces better housing, etc.

3. Industrialization and urbanization should also be seen as increasing the complexity of interdependence.

SOCIAL STUDIES

a. Consider the new needs of growing cities for housing, water, services, goods, etc. Each household became dependent on hundreds of individuals and agencies; people now had to rely on others they didn't know personally and often never saw.

b. Manufacturing, too, developed larger, more complex systems.

For example, in studying how Standard Oil, or some other company, began to gain control of an industry, ask the students about the kinds of systems involved -- mining, raw materials, pipes, shipping, railroads, wholesale and retail distribution, financing, etc.

c. Another way of seeing the growing complexity is to consider the ramifications of a single invention -- the automobile is perhaps the most striking example. Have the class consider such questions as:

- What businesses were phased out as motor vehicles became more important? (Blacksmiths, carriages, etc.)

- What new systems did automobiles bring into being? (Paved roads and highways, traffic laws, fuel, repair, etc.)

- How were people's lives changed? (Greater mobility, more rapid development of suburbs, new problems like traffic accidents.)

- How did automobiles change the natural evironment? (Pollution, demand for raw materials and energy, highway construction)

d. Industrialization, then, should be seen as establishing trends and patterns which continue through the present.

- Increasing and more complex patterns of interdependence.

- New ideas about growth and the exploitation of natural resources.

- Changing relationships between people and environment -- for many, built environment is a more noticeable aspect of life than natural environment.

- Sporadic attempts to preserve or restore portions of the natural environment.

D. Americans and Environment in the 20th Century

GOALS

- To investigate the advantages and disadvantages of increased interdependence.
- To recognize that population changes influence environmental issues.
- To determine the extent U.S. industrialization affects and influences the rest of the world.

1. The trends which began in the 19th century should be seen as continuing to shrink time and space.

SOCIAL STUDIES

a. People's daily lives become increasingly influenced by events far away -- an auto strike in Detroit, a crop failure in Brazil, a war in some other part of the globe.

b. A good question for inquiring is: what are the advantages and disadvantages of increased interdependence? (E.g., access to more places, more goods; a malfunction in one part of a system can have far-reaching consequences.)

2. Population changes influence the interactions of humans and the environment.

a. For example, consider an event like the Dust Bowl in terms of its relationship to population changes.

- What factors contributed to Dust Bowl conditions?
- How did it alter both the natural and built environment? (Land was wasted, farms and towns were deserted or impoverished.)
- How was the social environment changed? (Unemployment; development of migrant farm patterns.)

b. How has the development of suburbs altered human-environment relations?

- Consider how central cities were changed by the flight of middle class residents.
- Also, notice ways in which suburbs have gradually had to face the problems people had tried to escape -- pollution, congestion, high taxes, etc.

3. How has U.S. industrialization affected global systems?

   a. This question could be considered in terms of natural resources used by Americans (between 30 and 40 percent of the world output).

   b. An alternative approach is to consider American affluence as a standard other societies would like to achieve.

   c. What is our contribution to the pollution of natural systems?

SCIENCE

SOCIAL STUDIES

In 1970, the Royal Swedish Academy of Science reported that the U.S. accounted for human-made pollution to the extent of:

1/3 of the carbon monoxide

5/8 of the sulfur oxides

1/4 of the hydrocarbons

1/6 of the nitrogen oxides

1/2 of the particulates

Science classes could find out the major sources of each pollutant and learn something about the effects on natural systems.

Ask the class if they feel these statistics mean Americans should do more to correct environmental imbalances. If so, what kinds of actions would they recommend?

ADDITIONAL RESOURCES

Rocks, Rivers and Changing Earth. Herman Schneider. Addison-Wesley, 1952.

Learning About Nature Through Crafts. Virginia W. Musselman. Harrisburg, Pa.: Stockpole Books, 1969.

The Continent We Live On. Ivan T. Sanderson. Random House, 1962.

Foxfire Books, Vols. 1-3. Eliot Wigginton. Doubleday, 1971.

Our Changing Continent. U.S. Department of the Interior, Geological Survey, U.S. Government Printing Office, Washington, D.C. 20402, 1975.

Understanding Technology. Charles Susskind. The Johns Hopkins University Press, 1973.

V. STUDYING OTHER CULTURES OR WORLD REGIONS

(Many of the ideas in this section can also be applied to courses in world history and introductions to the social sciences.)

A. Comparing Cultures

GOALS

- To compare the built environment of different cultures.
- To note the many diversified ways peoples of different cultures relate to their environment.
- To trace the global interdependence of cultures.

A basic purpose of studying other cultures is to make comparisons -- to explore human commonalities and differences. At the same time, it is through the study of other cultures that we learn to understand our own. Comparison and self-awareness should also be the goal of lessons and units which focus on human-environment relations.

Often, however, in our study of other cultures, we become so involved in details of analysis that we lose sight of the desirability of having students draw comparisons. To counter this tendency, here are some ideas for on-going projects, to which additional items can be added as new cultures are introduced. In this way, the class will be engaged in activities which highlight points of similarity and difference in the way various human groups interact with their environment.

1. Create an on-going project of building structures around the world -- relying either on artistic representations or the construction of scale models. Use drawings or photographs to indicate variations within the culture.

ART

INDUSTRIAL ART

a. The actual work and descriptive accounts should take into consideration:

- What materials are used and why.
- How structures help people adapt to environmental conditions.
- The nature and purpose of design and decoration.
- The project group's feelings about what the structures suggest about human-environment relations in this culture.

b. When a new culture is studied, have another group prepare a second display. Over the course of a semester, then, there could be three or four visual representations of structures. This, plus the students' involvement in the projects, will provide a continuing awareness of similarities and differences. Care should be taken that displays are properly protected, locked display cases, if available, probably being the best solution.

2. Create a continuing record of people's feelings about human-environment relations.

ART

ENGLISH

MUSIC

a. Study the folk art of the culture -- create comparative bulletin board displays if desired. Note ways people use art to express their feelings about the world around them -- their food sources, homes, gods, landforms, etc.

b. The literature of the culture can be used for the same purpose. In previewing stories, legends, and poems make a list of questions pertaining to human-environment interactions.

For example: why are the seasons important in this story? Have we encountered examples with a similar emphasis in other cultures? How would you explain the similarity?

c. If at all possible have some of the material read in the language of the society being studied. Recordings or exchange students living in the area could be utilized, or help sought from language teachers. This activity should include some introduction to the language; even this limited experience will have great value in helping students understand language as a basic component of culture. As Frank Grittner points out: "Diversity of language is a fact of human existence. . . . A person who has failed to acquire minimal proficiency in at least one foreign language has missed an experience which is essential to understanding the world he lives in. . . ." (*Teaching Foreign Languages*, Harper & Row, 1969, p. 36).

d. Obtain recordings -- or arrange live performances -- of the music of the culture.

- Without making it an assignment, encourage students to write down impressions of what they hear.

- A music teacher can help explain the uniqueness of non-Western music but can also point out universal ideas of rhythm, melody, etc.

- Explore ways in which folk music is used to convey feelings about nature, seasons, crops, hunting, etc.

- Make comparisons with regional folk music in the United States.

3. Another on-going activity would be to keep track of ways each culture is increasingly becoming involved in global networks of trade, production, communications.

   a. Using a macro-lens, students could reproduce book photographs of increasingly modern cities in every culture or region.

      - The students will see that the world's cities are coming to look more and more alike.

      - Challenge the class to find specific examples of global interdependence in the pictures. (Press, vehicles, architecture, Coca-Cola signs, etc.)

   b. Some questions to consider:

      - Does our community have any ties with the society or region being studied? (Business, church groups, tourists, exchange students)

      - Do other countries depend on this culture in any way? (Resources, manufactured or hand-made goods, food items)

      - What global companies operate in this society? How might these companies (Pepsi-Cola, General Motors, Nestlé, etc.) influence the way people live?

B. Tradition and Change

GOALS

- To observe the effects of modernization on non-industrialized countries.

- To distinguish between the advantages and disadvantages of modern technology in developing countries.

Modernization, often accompanied by a tug-of-war between tradition and change, is a theme common to all societies in today's world. Even the most primitive groups are no longer immune from the forces creating an interdependent world. The Tasaday in the Phillippine rain forest, for example, have had their stone-age culture plunged into change by the outside world; even the gift of a simple tool like the bolo knife drastically alters their relations with the environment. (E.g., they can get food more easily, but now run the risk of over-using their resources.)

An important theme to develop in studying any culture, then, is how modernization changes human-environment interactions.

1. If the society was once colonized by Western powers, how did people react to the Europeans (or Americans) and their advanced technology?

   a. Why were they unable to resist being colonized? (Lack of central authority, modern weapons)

   b. We speak of "culture shock" when Americans encounter disturbingly different customs in another culture. What kind of culture shock did the society being studied experience?

   c. How did colonial powers alter the natural environment? (Industry, cash crops, mining, transportation)

      Consider, for example, how the construction of a railroad would change the lives of native peoples.

   d. How were people's relationship to the environment changed?

      (Occupations were changed; often sex-roles were changed, too -- e.g., in Uganda, where women traditionally grew crops for family consumption, men were now urged to grow cash crops.)

      Notice that the native peoples gradually obtain greater control over their environment through the use of modern technology.

2. What have been the advantages and disadvantages of trying to modernize?

   a. Modern medicine and health practices, for example, reduced the death-rate and extended life expectancy. But new problems also emerged in the form of rapid population growth.

   b. What are the advantages and disadvantages of urbanization?

      - Identify the major cities; why are they growing so rapidly?

      - What lures people from traditional lifestyles to the city? (The hope for jobs, more excitement)

      - What problems do newcomers to the city encounter? (Lack of jobs, housing, sanitation, etc.)

      - In all cultures, including our own, the move to cities represents a drastic shift of environment for the people involved. What adjustments have to be made and how do people make them?

   c. Why is the society trying to modernize? What obstacles does it face?

- People want higher material living standards, but in many Third World countries, the rapid doubling of the population makes it difficult to develop the basic structures needed for industrialization (food surplus, transportation, manufacturing plants, capital, etc.).

- What evidence do you find of people being caught between tradition and change? I.e., what do they miss of the old ways? What kind of compromises do people try to make?

- Note that modernization brings with it many of the environmental problems now being faced by industrialized countries -- pollution, overuse of resources, congestion, etc.

d. In what ways does modernization involve increasing interdependence with other parts of the world?

- Consider such factors as: the need for sources for raw materials and markets for finished products; the need for modern technology and manufactured goods.

- Using sources from the *Readers' Guide to Periodical Literature*, have students find out how global corporations are involved in the society being studied.

ADDITIONAL RESOURCES

Deciding How to Live on Spaceship Earth. Rodney Allen, et al. Littell and Co., 1973.

People in Twilight. Adrian Stoutenberg. Doubleday, 1971.

Our Plundered Planet. Fairfield Osborn. Pyramid Publications, 1968.

VI. ENVIRONMENTAL ISSUES: THE LOCAL COMMUNITY AND THE GLOBAL COMMUNITY

A. Population and Environmental Issues

GOALS

- To recognize that population changes influence all other environmental issues.

- To understand that individual decisions influence population changes and that population changes, in turn, affect individual decisions.

- To recognize that individuals can contribute to environmental deterioration or to the creation of a healthier environment.

All environmental issues are influenced by changes in population. Dealing with this all-important factor does not mean that you have to become an advocate of zero population growth. In fact, a sound case can be made for the thesis that the U.S., at least, is far from being overcrowded and can provide high living standards for many more than our present population of 210 million. The goal in dealing with the subject should be to develop understandings about: how individual decisions influence population change; how population change influences the decisions we make about environmental issues. Here are some questions to explore:

1. How will individual decisions influence population changes?

   a. Reproduce the chart on the next page.

   b. Combine this with data on food or other resources used per person. Or waste. If the average American produces five pounds of garbage per day, what predictions can you make about the year 2000.

      - What factors besides numbers of children will influence environmental quality by 2000?

      - For example, what kinds of individual decisions might we make about consumption patterns, or waste, or population distribution?

2. Use the following statement as a hypothesis to be tested:

   "Population changes not only affect each of us personally, but each of us in turn makes choices that create the changes." (*Options*, p. 4*)

   a. Have the class make lists of ways individuals are affected by population changes, and of personal decisions that create the changes.

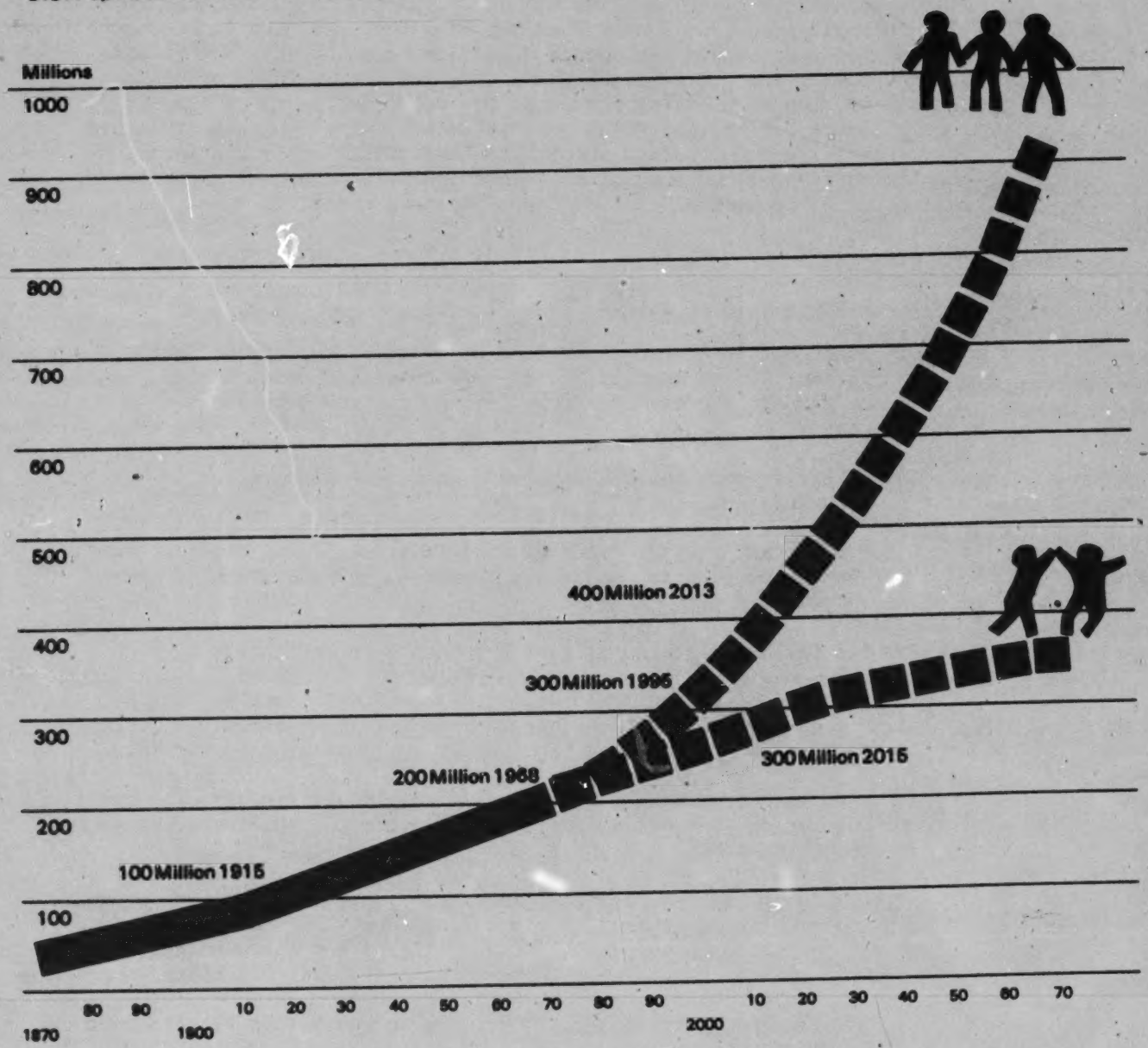
      (1) Forty million Americans move each year. How have the students been involved in this migration? How were their lives affected by any moves? (Adjusting to new surroundings, making friends, etc.) Were these moves individual decisions -- or was there pressure for the family to move because of changing patterns (e.g., factory or business moving to another location)?

      (2) How do the students think their lives might be affected by moves in the next ten years?

   b. Use aerial photographs or maps which will show how your community has changed over the past century. (Real estate agents are a good source for these.)

* See description of *Options* on p. 16.

U.S. Population: 2 vs. 3-Child Family



The population of the United States passed the 100-million mark in 1915 and reached 200 million in 1968. If families average two children in the future, growth rates will slow, and the population will reach 300 million in the year 2015. At the 3-child rate, the population would reach 300 million in this century and 400 million in the year 2013. (Projections assume small future reductions in mortality, and assume future immigration at present levels.)

Sources: Prior to 1900—U.S. Bureau of the Census, Historical Statistics of the United States, Colonial Times to 1957, *1961. 1900 to 2020—U.S. Bureau of the Census* Current Population Reports, *Series P-25. 2021 to 2050—unpublished Census Bureau projections. Beyond 2050—extrapolation.*

Reprinted from *Population and the American Future*, The Report of the Commission on Population Growth and the American Future, Washington, D.C., 1972, p. 23.

(1) What kinds of growth have occurred? (Usually urban growth followed by suburban sprawl)

(2) List some individual decisions that created change.

- People wanting homes in suburbs.
- Opening of shopping areas to serve suburbs.
- Tall buildings -- perhaps as monuments to progress.
- Businesses seeking space to expand.

(3) List decisions that were the result of planning, (e.g., housing developments; highway systems).

(4) What problems have been created by -- or aggravated by -- lack of planning? (Congestion; lack of recreation areas or open spaces; neon jungles; pollution -- whatever the students pick out as unsighty or unpleasant)

c. Have students make a mural of sketches, photographs, paintings which show how individual decisions influence changes in the environment -- natural and built.

PHOTOGRAPHY

ART

3. Is the U.S. in danger of overcrowding?

a. The majority of Americans live in urban areas taking up about one percent of the land surface.

- What are reasons for this density? Why do people seem to prefer urban areas?
- How does U.S. population density (people per square mile) compare with other countries?
- How do you think our lives would be changed by a population density like that of Western Europe?

b. How have changing patterns influenced life in suburbs? In central cities?

- Is there a move back to rural areas? How can you find out? What do you think the personal reasons are for such a decision?
- How has your local community tried to plan for future growth and shifts in population? Visitors from local government or planning commissions can be most helpful in dealing with this question.

4. How do Americans make use of their land area?

   a. Find out how the total land area of the U.S. is divided and utilized:

      urban areas and roads
      parks and wildlife refuges
      grazing
      forest
      crop land

      How is this changing? Which areas are growing or shrinking and why? (E.g., national parks have increased by 20 percent in a decade, usage has doubled.)

   b. How much land is needed to produce food for each individual?

MATH

SOCIAL STUDIES

The average American directly consumes 150 pounds of grain annually (cereal, bread, etc.) and 1350 pounds indirectly (grain for meat). It takes one acre to produce the grain directly consumed by one person plus 4-1/4 acres for grazing and raising feed grains -- thus 5-1/4 acres for each person for meat and grain.

How many acres are needed to produce the grain and meat for:

(1) your school

(2) your community

(3) the total U.S. population?

Challenge the class to establish what they feel would be a sound land policy for the next 50 years. Consider projected population growth and shifts in population. How would the students like to see the land used? What would they do about parks? Should meat production be reduced, etc.?*

5. Using whatever medium desired -- poetry, creative writing, art, photography -- ask students to project themselves 20 years into the future. What changes would they like to see in terms of (a) their personal surroundings; (b) the natural and built environment of the local community.

ART

ENGLISH

In discussing their work, consider how their projections would be influenced by events (a) elsewhere in the U.S.; (b) elsewhere in the global community (e.g., how would an increased world food problem affect their projections?).

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* Adapted from *Equilibrium*, Zero Population Growth, Vol. II, no. 1, 1/74 and Lester R. Brown, *Population Bulletin*, Population Reference Bureau, Vol. 29, no. 2.

the global community (e.g., how would an increased world food problem affect their projections?).

B. The Surprise Effects of Environmental Changes

GOALS

- To recognize that consequences of environmental changes can not always be accurately anticipated.
- To see the necessity of critically analyzing all proposed environmental changes.

By this point in their study, the students should recognize that a change in one part of an environmental system sets off changes in other parts. Sometimes the effect of change is very complex and sometimes quite unexpected. Here are some ideas for lessons that will impress upon students the difficulty of predicting the consequences of environmental changes.

1. Explore examples of the surprise effects that have resulted from some human-made changes in the environment.

SCIENCE

a. Science or social studies texts are likely to provide a few examples:

- DDT was used to control malaria in a South American town; it also killed cats, leading to an increase in wild mice-like animals which were carriers of typhus, resulting in an epidemic.
- What have been surprise effects of trying to control pests with the introduction of another species? (E.g., the mongoose in Jamaica)

b. Major efforts to change the environment should be explored in terms of their long-range consequences, both good and bad.

The Aswan High Dam is a good example -- and a major project to change environment. Use outside sources to find unexpected consequences.

c. Consider the use of fertilizers and long-lasting pesticides in U.S. farming.

(1) What were the benefits of these changes? (Greater crop yields; profits for farmers; more abundant food supply.)

(2) What were the unexpected consequences -- or surprise effects?

- Consider in some detail the chain-effect of both pesticides

and fertilizers in terms of their involvement in food webs, land run-off, harmful effects in foods.

- Notice that we often face difficult decisions because of these surprise effects. For example, DDT has been almost totally banned in this country. It is still used elsewhere -- does usage in other parts of the world affect our environmental health? (Yes -- because of the interdependent nature of environmental systems.) But what would be the consequences of a world-wide ban on DDT? (increased rate of some diseases, perhaps greater food shortages.)

2. In view of the side-effect problem, how do we make environmental decisions?

   a. Consider pending decisions in your community -- a new highway, enlarging the airport, building an oil refinery or a nuclear plant.

      - While the issues may be too complex for students to take a firm stand, they should be able to come up with a list of questions that should be considered in the community's decision, e.g., what other systems will be affected? In what way?

      - These questions could be used for interviews with those active in making the decision -- developers, government agencies, conservation groups, etc.

   b. The same technique of discovering what questions to ask could be applied to non-local issues -- the Alaska pipeline, mining the ocean floor, off-shore oil drilling, clearing the Amazon jungle for farming, etc.

      - In all cases, the class should consider what systems are involved or might be.

      - They should also raise questions about the benefits that will result from a particular project.

C. Exploring the Conflicts Behind Environmental Issues

GOALS

- To realize that there are no simple solutions to environmental problems.
- To develop problem solving skills in handling environmental issues.

It is important for young people to recognize that environmental problems -- and their solutions -- involve very real conflicts of interest. Air pollution, for instance, is not simply a matter of profit-hungry manufacturers destroying the atmosphere in their search for more money. Students should realize that each of us makes daily decisions that contribute to the problem. In addition, the search for solutions can cause hardships for segments of the population -- higher taxes, loss of jobs, restrictions on freedom, and so on.

1. Explore the issues involved in trying to protect the natural environment.

   a. Here's one example: Only 40 sandhill cranes remain in existence, so clearly the species is close to extinction. Moves are underway to designate 100,000 acres in the state of Mississippi as "critical habitat," which will stop all economic growth in that area. The residents are worried. As one Mississippian wrote: "I can't imagine anyone with any intelligence or common sense even considering giving 100,000 acres of land to 40 old birds." (Quoted in *The Wall Street Journal*, January 9, 1976)

      - Can we afford to set aside that much land to protect the sand crane?
      - Can we afford to surrender economic growth for critical habitat?
      - How is our growing interdependence involved in answering such questions?
      - How are population changes involved? (E.g., growing national and world population requires more land for food, resources, living space.)

   b. Explore a series of such examples. Have the students find out what the conflicts are and how they would resolve them. Possibilities:

      - the California redwoods

- the crocodile
- the grizzly bear
- the whooping crane
- the California condor

c. The Interior Department is trying to increase some animal populations by raising young and then returning them to a natural setting.

Have the students find out more. Do they agree with the policy? Why or why not? (The timber wolf is one such species. Farmers complain that the wolves kill livestock. How could the conflict be resolved?)

2. Provide the class with other kinds of environmental issues.

a. Have students:

(1) identify the conflict;

(2) consider who should handle it -- individuals, local, state, or national government;

(3) discuss what solution they would recommend.

b. Consider examples in the local area -- like a factory or mine that can't afford anti-pollution devices.

c. In all such cases, the students should explore ways that interdependence is involved. (E.g., how does the factory's pollution involve natural systems that extend beyond the local area?)

How might people in other areas be affected -- job losses if the factory closes; added health hazards if it remains open?

3. In concluding the lessons on environmental issues, have the students recall the Spaceship Earth idea. Ask them to show how local concerns they have dealt with are related to globe-wide issues.

ADDITIONAL RESOURCES

One Earth, Many People. Lawrence P. Pringle. Macmillan, 1971.

Ecology: Science of Survival. Lawrence P. Pringle. Macmillan, 1971.

Environment: Earth in Crisis. William F. Goodykoontz and Sandra Breuer, eds. Scholastic Book Services, 1973.

An Introduction to Population, Environment, and Society. Lawrence M. Schaefer. E-P Education Services, 625 Orange St., #38, New Haven, Connecticut 06511.

Options: A Study Guide to Population and the American Future. The Population Reference Bureau, Inc., 1755 Massachusetts Ave., N.W., Washington, D.C. 20036, 1973.

Earth: Our Crowded Spaceship. Isaac Asimov. The John Day Company, 1974.

AUTHORS

David C. King is principal writer and general editor for the Center for Global Perspectives' project, Population and Other Environmental Concerns: A Project for Developing Curriculum Guides and Handbooks Using Interdependence as an Organizing Concept. He is also co-director of the Center's project, Global Perspectives: A Humanistic Influence on the Curriculum. He has taught English and social studies and is the co-author of *Foundations of Sociology* (Holt, Rinehart and Winston) and of the fifth grade text in Houghton Mifflin's new social studies series, Windows on Our World.

Ann de la Sota, author of the K-3 Handbook, is a staff member of the Mankind Schools Project, Institute for the Development of Education Activities (I/D/E/A).

Cathryn J. Long, author of the 4-6 Handbook, is a writer on the Center for Global Perspectives' staff. She has taught English at the University of California, Berkeley where she is engaged in a doctoral program.

Peter R. Stillman, developer of the 7-9 Handbook materials, is a teacher at the Carlotte Valley Central School, Davenport, New York, and a free-lance writer.

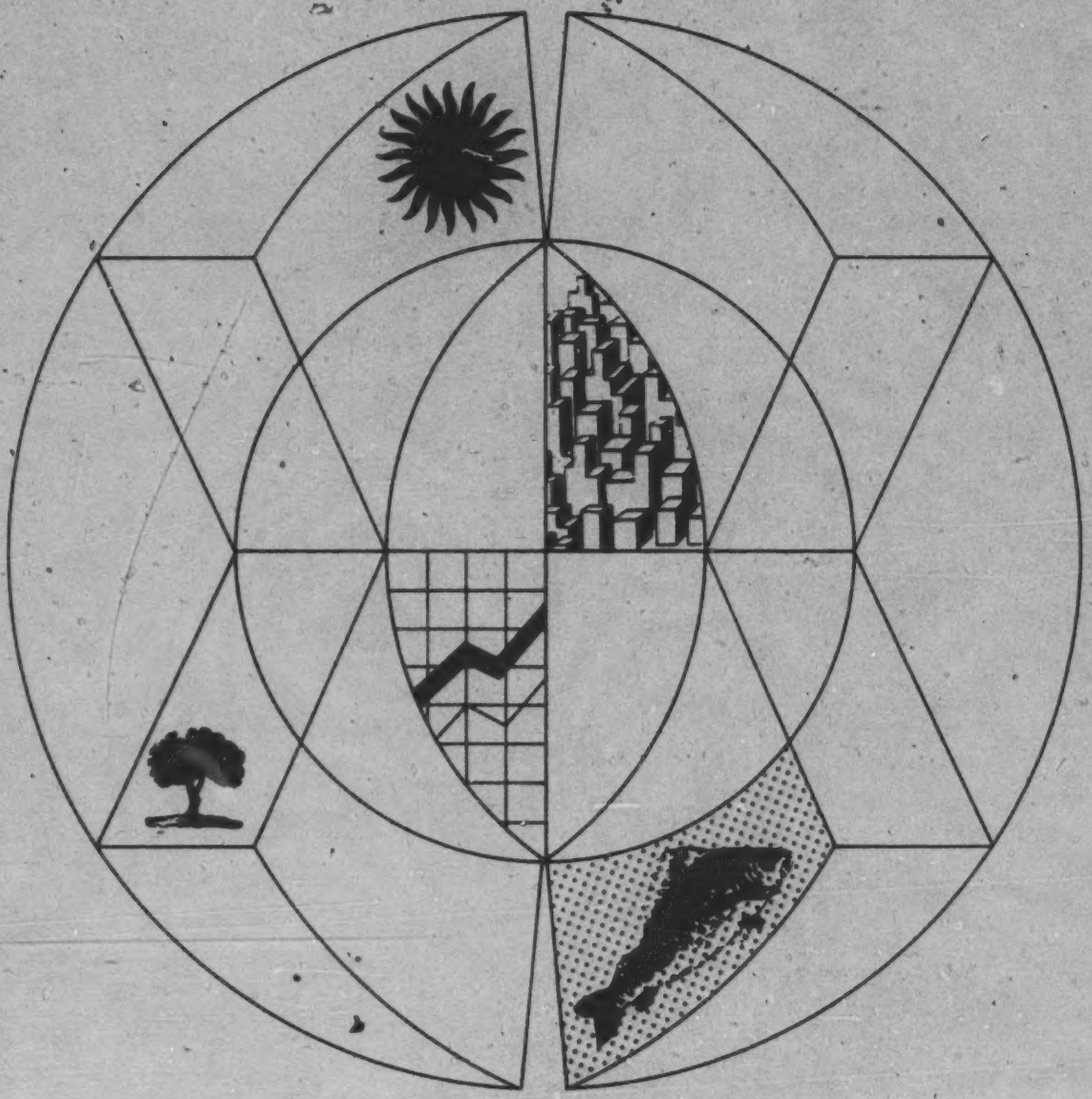
Jayne Millar Wood, co-author of the 10-12 Handbook, is Director of Public Education for the Overseas Development Council.

EDITORS

Andrea B. Karls has taught elementary school and junior high social studies. She is on the staff of the Center for Global Perspectives and is Associate Editor of INTERCOM.

John Boeschen is a doctoral candidate in education at the University of California, Berkeley. He has taught science and is currently writing a science text for Harcourt, Brace, Jovanovich.

Part C
7-9 Handbook



Environmental Education
Interdependence: A Concept Approach

PETER R. STILLMAN
Editor: David C. King

CENTER FOR GLOBAL PERSPECTIVES

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ENVIRONMENTAL EDUCATION

INTERDEPENDENCE: A CONCEPT APPROACH

HANDBOOK GRADES 7-9

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UNIT 1: STRIKE!

GOAL

To apply knowledge of systems and interdependence in analyzing environmental issues and the interaction of humans and their environment.

INTRODUCTION

One way to develop an understanding of interdependence is to observe what happens when a key system in an interdependent network stops functioning. It can wreak havoc. A strike, regardless of its size, is deliberately designed to demonstrate this. If it didn't, strikes simply wouldn't happen.

The scenarios in this unit may at first appear to add up to an anti-strike, or even anti-labor, point of view. Such a point of view is not intended here, nor should that conclusion be drawn. The people and situations depicted are presented as symbolic of our dependence on interlocking systems within our environment -- both natural systems and those created by numbers. The plights of those affected may evoke sympathy, in as much as some of these people are hapless victims of a system in which they have placed their faith. But just as many people, perhaps more, would suffer by the disruption of any other key system (the N.Y.C. black-out, for instance) in which no politico-economic ideologies figure.

This unit also emphasizes the idea of interdependence as a state of being -- not something we choose or necessarily favor. In fact, students should see that it is often a difficult condition, since we depend on events and actions we can't control. These scenarios may be used in many ways, depending on student ability, the time factor, how the material lends itself to the instructor's objectives, and in what worthwhile directions the materials seem to move. Some suggested applications follow. They range in complexity and objectives and probably should not all be undertaken by the same group. The only necessary equipment is some kind of duplicating machine for reproducing the scenarios for student use.

Getting at the Systems Concepts -- Suggestions:

1. What does the collapse of a major subsystem (one airline of many functioning as one component of the larger subsystem of air transportation) reveal about interdependence in our society? What does it reveal about our systems of priorities?

2. What kinds of globally interdependent systems are woven into this one? We didn't touch on mail or intercontinental air freight (the components manufactured in Akron were to be fitted into computers in Ankara) etc., etc.

3. At the very center of this lesson is the classical confrontation of two systems -- management and labor. Ordinarily, texts examine this formally and with reticence. While management and labor do get along in our society with astonishing smoothness, there are times when these systems clash in open contention. This proposed lesson *is not* a case study of such a clash. It is a vehicle for revealing the kinds of interdependent systems that operate beneath the observable level and aren't thought about until they malfunction. However, the problems exposed in such a clash are dramatic avenues into a close examination of the strike function. They also reveal the basic and healthy kinds of issues that are implicit in management and labor systems, and the sometimes uncontrollable and unanticipated radiating effects of such a confrontation.

4. Community resources -- travel agents, airline employees, purveyors of services and goods to transportation systems, etc. -- can be tapped. The most important resource is the instructor, whose ingenuity can make much or little of this scenario.

Group and Individual Projects

1. The scenarios can be looked upon as a series of problem-solving challenges, with students taking on roles that appeal to them. It shouldn't take a formal lecture on systems and subsystems to get them into the idea. Simply set the scene and let them develop alternatives to the systems that have broken down.

2. Two related demonstration techniques should work well in complementing and undergirding the systems implications of this unit. Both involve individual or group presentations:

   a. In chart form, incorporating a silhouette outline of a jetliner and arrows pointing to its various compartments, have students label the systems. Suggested labels would include: freight, baggage, passengers, purifying chemicals, quick-frozen meals, beverages, ice, fuel, oxygen, pillows and blankets, reading matter, flight information, etc. Each of these involve a number of subsystems which could be examined and discussed in class.

   b. Again in chart form, using the terminal as the central object, have students indicate the less immediate subsystems incorporated into every flight. These might include reservations, billing, shuttles, parking, late arrivals, preflight meals, etc. (It might be interesting to discuss how a breakdown of one of these subsystems would affect the functioning of the airport.)

STRIKE!

Lon Baxter started edging the silver and blue semi through three lanes of early morning commuter traffic. He was heading toward the service road a half-mile ahead. He mumbled to himself as he listened to a commercial for Valley National's Christmas club plan. "Christmas. Haven't finished paying for last year. Same thing every year, and I'm getting...."

A Buick full of executive types tried to slip by on the right, ignoring his flasher. Lon kept moving right anyhow, careful to avoid a collision. His bulky rig was going to win the argument. Later his boss would receive a telephoned complaint. A Blue Arrow Freight truck had tried to run the caller off the road that morning.

The overhead sign read: **Freight Terminals: Horizon, Pan Pacific, Cherokee.** Nearly half of Blue Arrow's business came from Cherokee, the biggest domestic airline in the U.S.. Cherokee billed itself as the top passenger line going. But it was only after he was hired that he learned a huge amount of their business was in freight. Riding behind Lon in the trailer were exactly 312 of these freight parcels, picked up two hours before from Delta Electronics. They were destined for seven different precision tool manufacturers scattered across the Midwest. In all likelihood, they would reach their destinations that same day.

Lon watched a 747 jumbo jet clear the runway and head out over Flushing Bay. "The size of those monsters," he wondered aloud. "How do they even get off the ground?" Then something else caught his attention as he rounded the final curve and swung downhill.

It was business as usual beyond the high wire fence that surrounded the loading docks -- a jumble of trucks and men.

Except that at the Cherokee dock nothing was moving. Nothing except a line of about a dozen men, bundled against the cold and carrying large placards. Four other rigs stood blocking the way in front of him, so Lon set his brakes and climbed down from the cab. He joined the other drivers standing around the truck at the head of the line. "What goes, Hersh?" he asked of Tanner Transport's white-haired senior driver.

"What's it look like, Baxter? First time you've seen a picket line?"

"Of course not," Lon said. "But last time I heard -- six o'clock news last night -- they figured things were going to get

settled without a shut-down. I made a pick-up at Delta at 5:30 this morning and nobody out there said anything about a strike."

"Right," said Charlie Riggs. "They pulled a beaut. Supposed to settle by six this morning and it looked real good. The freight handlers agreed to the new contract, the baggage guys okayed it, the porters went along.... Know who shot the whole thing down? Would you believe the terminal maintenance section -- the guys who keep the toilets flushing? Cherokee's got 40,000 employees and 520 of them shut down the whole airline! They're holding out for twenty-two cents an hour more. What a stunt to pull and ten days before Christmas. A real beaut!"

Half an hour later, his load still aboard, Lon pulled into his favorite diner. He ordered coffee, then headed for the phone booth. Dick Albano, Blue Arrow's dispatcher, came directly to the point: "Bring her in, Lon. It's a lousy way to come into Christmas, but it looks like a lay-off. Sorry."

* * *

Edward Pope tipped the cabbie an extra dollar, then waved to a porter. He took no notice of the small line of pickets or the airport policemen standing by the six entrances to the passenger terminal. "Drop them off by the Cherokee counter, porter," Pope said.

Pope got in the shortest of three long lines at the counter. He glanced at his watch. Because he was used to such delays, he was soon lost in his newspaper.

"Good morning, sir. I'm sorry about the delay. May I help you?" Edward Pope looked up in surprise. Across the counter an attractive, uniformed ticket agent smiled at him. The plastic badge on her blouse identified her as A. Lindstrom.

Pope drew an airline ticket from his inside jacket pocket.

"Morning," he answered. "Edward Pope, flight 116, Kansas City, first class. Like a window seat if possible." Miss Lindstrom's smile remained. But Pope, noticing a tired kind of tension around her eyes, felt a tiny warning buzzer go off somewhere inside him.

"We're terribly sorry, Mr. Pope. We have had to cancel all flights. Cherokee is on strike. We'll do our best, of course, to make arrangements for you on another airline. However, there may be a wait."

Miss Lindstrom was still smiling, but now it looked frozen on her face. Furthermore, her speech sounded to Pope like a

mechanical recording. Pope smiled back. "That can't be, Miss. Just two minutes ago I read that there wouldn't be a strike." He pointed to the paper under his arm. "Now, please. That flight leaves in ten minutes."

"Sir, the strike *is on*. *We are* sorry. All Cherokee planes are on the ground. We will do our best, however, to...."

"Young lady," Pope said, his voice very firm, "in ten minutes I am getting on flight 116. In two hours and ten minutes I am getting off at Kansas City. If things don't happen precisely that way, I and my company will lose a very valuable contract. There is no way I can cancel my appointment, or arrive later in the day, or make this sale over the phone.

"Do you wish to speak with our supervisor, Mr. Pope?" she asked. "I'll see if he is available. Meanwhile, may I attempt to make other arrangements for your flight?" As Miss Lindstrom turned to summon the check-in supervisor on duty, a tear trickled down her cheek. Edward Pope was not the reason. She had so far dealt with many people more unreasonable than he was being. Miss Lindstrom was like many other Cherokee check-in and reservations clerks. She had been on duty for nearly twelve hours and she had been trying desperately to make arrangements for the first wave of an estimated 1,500,000 holiday passengers who had planned to fly Cherokee over the next four weeks.

Edward Pope did not make it to Kansas City in time for his sales presentation. He did not make it to Kansas City at all. After a nasty and pointless argument with the check-in supervisor, he gave up in disgust and decided to return home. Two days later, Pope dictated a memo to the eleven salesmen under him. They were never to use Cherokee Airlines in the future.

* * *

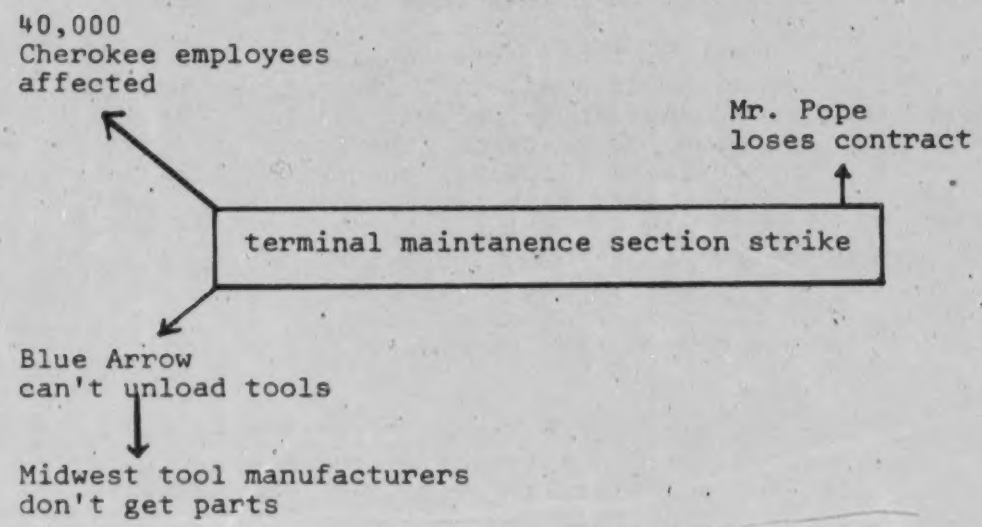
Five-hundred twenty employees go on strike. At first, it doesn't sound too serious. But, then, things start to happen. Look at the diagram on the next page. Events that happened because of the strike are shown at the ends of the arrows. What other events were mentioned in the story? Add them to the diagram.

* * *

In the next few days, other people would be influenced by the Cherokee strike, some drastically, some only slightly.

Charlie Harrington was a night shift repair foreman for the telephone company. He'd only had an hour's sleep when the phone rang. He was told to get out to the Cherokee reservations offices

DIAGRAM



Do you think these are the only happenings connected to the strike? Imagine. You're a reporter covering the Cherokee strike. What other events might the strike cause? Make a list of as many possibilities as you can think of. When you feel that your list is complete enough, begin reading the next section. Be sure to add all strike-related events to the diagram as you read.

in a hurry. Reservations clerks and concerned passengers had so overloaded the phone system that it was beginning to break down.

Charlie would work for seven straight hours before quitting. But the phones were to remain a problem for the next 24 hours. A crew of two phone company service men had to stay on duty at Cherokee until eleven that night. This caused a delay that lasted nearly a week in the servicing and repair of other business phones.

* * *

Mr. and Mrs. John Dragos and their two young children had left Athens, Greece the night before the strike. They had landed in New York early that morning. They were headed for Dragos' brother's home in Indianapolis, where they would spend the Christmas holidays. Their reservations called for them to connect with Cherokee flight 108 at 10:42 that morning. Instead, the Dragos, who spoke little English, spent the next night sleeping on the floor of the terminal. When they finally made connections to Indianapolis, they had to be routed through Atlanta, Georgia. To make matters worse, the lack of available seats forced them to take two separate flights. They arrived in Indianapolis twelve hours apart.

* * *

Sam Gladdings, president and owner of Mannerhouse Produce Wholesalers, made a reluctant announcement to his staff two days after the strike began. Mannerhouse, like Blue Arrow, relied heavily on Cherokee for much of its business. With Cherokee's huge New York food preparation center closed, Gladdings would struggle to keep his thirty-seven employees on. The annual Christmas bonus, however, was out. Most of his people seemed to understand.

* * *

One hundred-eleven other wholesale suppliers to Cherokee would see profits dwindle during the best business period of the year. And, of course, *their* suppliers would feel the strike's influence too, although less directly. Miguel Arambas, a poultry farmer 65 miles from Denver, would wonder where he could dispose of 230 turkeys. All of them had been cleaned, plucked, wrapped and quick-frozen for a Cherokee supplier, Gem Rapid. Gem had cancelled the order.

* * *

Two months after the Cherokee strike ended, a group of 145 school teachers from Providence, Rhode Island sued Carib Continental. Carib, a non-scheduled charter airline, had contracted to fly the group to Trinidad for a ten-day Christmas

vacation. Just two days before their scheduled departure, the group was informed that Carib had no available planes. They had leased their fleet of six jets to Odyssey Airways for the duration of the strike. Odyssey flew many of the same routes as Cherokee, and used the Carib planes and their crews for additional flights. It proved impossible for the teachers to make other arrangements on such short notice. They were very angry.

* * *

Bus companies were not unhappy about the strike. Although business was always brisk during the holiday season, this year it boomed. The major long-distance bus lines added extra vehicles and reaped an unexpected profit. Passengers, however, complained of overcrowded terminals, late buses, lost luggage, dirty vehicles, and rude personnel.

* * *

Most viewers probably didn't realize that the two key play-off football games scheduled for the first Sunday after the strike nearly didn't come off. Cherokee was the official airline of the Continental Football League. One flight was to have carried the New York Lions to Chicago -- players, coaching staff, trainers, miscellaneous personnel, and equipment. Another flight, from Portland, Oregon to Dallas, Texas, was also scheduled to carry a division championship team. The Lions reached Chicago's O'Hare International Airport on three separate flights. The last one arrived only two hours before game time. They lost the game. The Portland Caribous had managed to charter a 707, which took the entire team with room to spare. Portland won. The loss of these two round-trip flights cost Cherokee only about $35,000. This was peanuts when compared with their overall loss in flight revenues. That figure came to more than $16 million.

* * *

The airline's monthly magazine, *Cherokee Trails*, was distributed free to all Cherokee passengers. Of the 550,000 December issues printed, more than 200,000 ended up in warehouses. Eventually they would be sold for scrap at an average of thirty cents per hundred pounds. This added up to $250. But it had cost the airline over $60,000 to print those 200,000 copies.

* * *

Because of freight back-ups, important items were delayed in transit, from a day to three weeks. One delay involved two essential replacement parts for an artificial kidney machine in an Omaha hospital. Delivery of the parts was not a life-or-death matter. But it did cause the postponement of a very serious operation on an eleven-year-old boy, ruining any chance of his observing Christmas with his family.

* * *

For three hundred passengers in Cherokee's San Francisco terminal, the morning of December 15 would be long remembered. The crowd, many of them college students, included the Celestial Flames. Leaving it up to their manager to find them seats, the Flames staged an impromptu rock concert. The kids loved it, but more than 25 people complained to terminal personnel about the noise.

* * *

All these incidents made news, some in the form of feature articles, some as human interest stories. Here is a sampling of other people affected by the strike who did not make the news:

- A maintenance crew in New York who had to bed down 47 jet liners so that they wouldn't freeze up, spring leaks, get flats, or otherwise suffer from being laid up.

- A pickpocket who made one of the biggest hauls in his career after viewing the midday news footage of the jammed Los Angeles terminal.

- A Cherokee baggage handler who was laid off with only six weeks to go before retirement.

- The Seattle symphony orchestra whose holiday concert season was to have opened with the guest appearance of one of the world's great violinists. He was forced to postpone his appearance for two days, which resulted in nearly six hundred ticket cancellations.

- The manager of the Trinidad resort where the Providence teachers were booked to stay.

- The picket in Detroit who was arrested for blocking a terminal doorway and refusing to move.

- Three Cherokee stewardesses in various parts of the U.S. who decided to quit flying and get married on Christmas Eve.

- A computer analyst who rented a car to drive from Chicago to Cleveland, fell asleep at the wheel, and narrowly missed being killed.

- The man who sold his seat on another airline for $100 more than he paid for it.

- The nearly 50,000 people who never made it to where they wanted to go.

FOR DISCUSSION

How do the events described in this section compare to your original list? Do you think all the happenings related to the strike could ever be listed in a magazine or newspaper article?

What does your diagram look like? Describe how a "complete" one might appear. Now pick an event at the outermost edge of the diagram. Trace it back to the original strike. How many different effects of the strike is it linked to? Describe some of the possible effects this last event could have. Could it affect you?

UNIT 2: JETS, JACKHAMMERS, AND LEAKY FAUCETS

GOALS

1. To apply knowledge of systems and interdependence to analyze environmental issues and the interaction of humans and their environment.

2. To develop more constructive attitudes toward one's own surroundings.

3. To recognize that individuals can contribute to further environmental deterioration or to the creation of a healthier environment.

INTRODUCTION

Noise is directly related to the systems of our society. Although it takes many forms, these have in common a single quality: unpleasantness. Noise irritates us, makes us angry, uncomfortable, tired, nervous, ill, slower to learn, quicker to forget. Noise is different from "sound." The latter is judged to be pleasant or at worst neutral. While one person's noise can be another person's sound, there is general agreement for the most part that certain shapes and intensities of sound waves reaching the ear are *noise*, as opposed to sound.

It is the purpose of this unit to examine noise as (1) a by-product of many systems; and (2) a function of many other systems. The unit does not examine the physics of the physiology of noise, or approach the subject as a straight environmental issue. It will be nearly impossible and perhaps unwise, however, to avoid getting into these two aspects of the subject.

A major hoped-for outcome of this unit will be the development of some useful theses and value judgments -- not so much about noise as a phenomenon or a pollutant, but as a unique utterance of our society's progress. Depending on what directions teacher and students take, any and maybe all of the following theses will emerge:

- Noise is a function of many systems (warning systems, regulatory systems, communication systems, recreation systems, protection systems, etc.).

- Noise is a by-product of many systems (clattering garbage cans = sanitation system, air hammer = building-housing systems, typewriter = communication system, etc.).

- Hence, some systems produce noise intentionally; other systems produce it by accident, or unintentionally (or as a built-in but useless component; or as a side effect, etc.).

- Noise as a by-product is generally undesirable.
- Noise tends to be accepted in more or less direct proportion to the value we place on the system that produces it.
- Noise can be physically, mentally and/or emotionally damaging, in long- and short-term ways.
- Sometimes we are not aware that noises are hurting us in these ways.
- Noise can cause conflicts (or ruptures or disagreements, etc.) between individuals, segments of society, or even nations.
- In the U.S. many people equate noise with power, efficiency, and productivity.

It's not very likely that any student will state any thesis quite this succinctly. Most students, however, should be able to paraphrase them to a recognizable degree. Furthermore, they should have fun deriving them from the material that follows.

The groupings of vignettes, data, and project and research suggestions can be used and evaluated in many ways. They are not interdependent or even necessarily connected. Materials that may be too simple or too difficult can be discarded without reducing the unit's applications. The time span can be anywhere from two days to a week or more. Almost no equipment or special facilities are required. There are opportunities for individual, small group, and full-class involvement.

A relatively simple way to introduce this unit in a class period is to give students a few minutes to read the brief items on the next two pages. You might ask them if they have ever felt like the man in the first selection. Why? What was it about the particular sound that bothered them? Ask if they would react to a fire-engine siren or an announcer speaking over a loudspeaker in the same way. This might serve as an appropriate introduction to the distinction between "noise" and "sound."

Have your students make two lists, one headed by "noise" and the other by "sound." Under each heading, let them jot down all the noises and sounds they can think of. If a student asks what you mean by the terms, explain that whatever the student classifies as such will do for the moment. Head up two columns on the board and write down a generous number of the sounds and noises they listed. Ask students how they arrived at the distinctions and have them attempt to define the two terms, based on the lists. This needn't be formalized; fragmentary characteristics are fine. Probably you will end up with the ideas that noise is annoying, while sound isn't; that the former tends not to be generated in patterns that we like to hear; that noise hurts or makes us nervous, while sound doesn't; that noise is louder than sound, etc.

JETS, JACKHAMMERS, AND LEAKY FAUCETS

Item: In Hartford, Connecticut, a man employed as a night watchman working the midnight to eight shift burst from the door of his home at midday waving a hatchet. He ran at a jackhammer operator tearing up a section of sidewalk in order to install a new sewer line. The operator fled, and the enraged man proceeded to chop up the air hose and destroy the compressor that drove the hammer. He was arrested and paid a $50 fine.

Item: Jet pilots taking off from New York City airports have stated that the most dangerous moment of flight occurs seconds after the plane is airborne, when strict noise regulations require that the engines be throttled back. Any one of a number of minor malfunctions at this point could cause loss of forward speed, a stall, and possible crash.

Item: In tests conducted with rats, loud noises of long duration at first produced hostile, aggressive behavior. Eventually, the animals became listless and indifferent to their surroundings, and experienced loss of appetite.

Item: In a recent marketing test it was found that a majority of consumers preferred a loud vacuum cleaner over a relatively quiet one, even though the machines otherwise performed identically.

Item: In Ann Arbor, Michigan, a 19 year-old university student was issued a traffic summons for having a faulty exhaust system on his car. In court he attempted to introduce evidence provided by the manufacturer of his special muffler system to the effect that it improved gas mileage and reduced engine wear. Although the evidence included technological data to back up the claim, the youth was told by the judge that his car was too noisy, regardless of how it might save on natural resources. He was found guilty.

Item: By putting together the findings of a number of studies and tests, scientists and medical researchers have come to the conclusion that we are suffering certain types of hearing deficiencies earlier in life than was the case a generation ago. This has been attributed to a general increase in noise levels in the U.S.

Item: Noise-level tests conducted in the New York City subway system produced hard evidence that passengers are subjected to levels of noise well beyond the standard for tolerable limits. Similar tests conducted on city streets during peak traffic hours yielded comparable results.

Item: Concorde, the supersonic transport jointly financed, designed and produced by the governments of France and Great Britain, cruises at 1400 miles per hour at altitudes of 50,000 to 60,000 feet. It is capable of carrying up to 144 passengers from New York to Paris in 3½ hours, half the time required by subsonic jets. Concorde, however, is too noisy to meet anti-noise regulations at U.S. airports. France and Great Britain are both understandably anxious to win landing rights here. The plane, developed at a cost of $2.5 billion, was to have earned back part of its cost transporting American passengers.

Noise-Systems Game

Refer to your class-developed lists of noises and sounds. Cross out all unnecessary noises and sounds from the appropriate list. Also cross out those which are random or seemingly random. For example, a barking dog, thunder, glass breaking, etc. When your class agrees on the remaining items, divide your students into groups of 4-6. Ask each group to identify each sound/noise with as many systems as possible. For example, truck=transportation system; typewriter=communication system; radio=communication-entertainment system, etc.

"I love you," she whispered at 15 decibels.

A decibel is an arbitrary unit of measurement for rating the intensity of sound. That is all students have to know about decibels to interpret the chart below. From the data on the chart, let students come up with generalizations regarding noise, systems, and society. (Students might come up with such ideas as: we are almost constantly subject to some level of sound -- often from a variety of sources at the same time; modern technology produces numerous sounds of high intensity, some beyond the threshold of pain; some sounds are likely to be harmful to our health; efforts should be made to reduce harmful noise levels.)

INTENSITY LEVELS OF SOUND

Type of sound	Intensity (db)
threshold of hearing	0
whisper	10-20
very soft music	30
average residence	40-50
conversation	60-70
heavy street traffic	70-80
thunder	110
threshold of pain	120
jet engine	170

Noise Log

An interesting individual project is the Noise Log, which can be used as an extension to the previous activity or as a discrete exercise.

Reproduce enough copies of the log sheet (p. 16) so that each student is provided with at least three or four. Also reproduce the instructions and one copy each of the sample log sheet (p. 17). These materials should be assembled in packets. The log should be kept for at least one day, preferably for two or three. One hour logging time at a sitting is plenty.

NOISE LOG

Time logged:

Noise source:

Noise duration:

Noise frequency:

Noise rating:

System(s) represented by noise:

By-product or function?

Conclusions and suggestions:

NOISE LOG

Time logged:

Noise source:

Noise duration:

Noise frequency:

Noise rating:

System(s) represented by noise:

By-product or function?

Conclusions and suggestions:

Instructions: You are to log noises in the home or penetrating the home. Exclude random noises. Log only those that are frequent, regular and/or systematic. Use a separate page for each noise. (A sample log page has been worked out for you.) "Time logged" means time of day. "Source" is where the noise comes from. Be specific; don't just say "kitchen"; put down "dishwasher," "electric beater," etc. "Duration" is how long the noise lasts. A beater might run for two minutes, while the dishwasher could produce a certain noise for ten minutes. A rough estimate is good enough. "Frequency" means how often the noise occurs during the entire logging period. If someone next door is running a chain saw, the duration might be five minutes at a time, but the frequency could be ten times in an hour's stretch.

"Noise rating" is the negative value you place on the particular noise. It indicates how much the noise bothers you, either mentally or physically or both. It should be expressed in negative numbers running from -1 to -5. Negative one should represent a mildly annoying noise, while negative five should be extremely annoying, even painful (someone hammering directly overhead, for example). What system does the noise represent? An electric beater would symbolize your food system; trucks going by outside would be involved with the transportation system; hammering would be connected with construction, home improvement, building, etc. (A noise can, and most often does, represent more than one possible system.) "By-product of function" asks you to determine whether the noise is intended as part of the system, or whether it is a side effect. (A fire siren is an intended function of the fire prevention system, but the racket an electric beater makes has nothing to do with its job.)

"Conclusions and suggestions" provides a place for your ideas about the responses you have logged on any one sheet. Are there ways to reduce the noise, or at least the noise rating? What possible alternatives might there be? What has your study of this one noise suggested about the system that produced it?

SAMPLE NOISE LOG PAGE Time logged: 7:15 a.m.

Noise source: fire siren, fire station, two blocks away

Noise duration: three minutes

Noise frequency: once, followed by sirens on fire trucks

Noise rating: -3

System(s) represented: fire protection, home protection, safety, warning

By-product or function? function

Conclusions and suggestions: Siren is useful. This is a valuable noise. Truck engines were loud too, however. This is a by-product. Some noises have value, but they can be connected with noises which don't.

As a follow-up to the Noise Log, students may assign a +1 through +5 rating to the system(s) identified, based on the importance of the system(s). By adding together the negative value of the noise and the positive value of the system(s), an arbitrary noise-system rating can be attained.

A number of other noise-system explorations might also be worthwhile. They are listed on page 15, in no order of importance or sequence. Where they take the class is a matter of teacher judgment.

Noise Guessing Game: Prepare a tape on which are recorded common noises produced by systems in home, school and/or community. Have students write down their guesses as to the source of the noise and the system it represents.

Noise in Pictures: Have students bring in photographs of noise. Don't elaborate on this request; half the value of the assignment is how the kids interpret it. Post the photos and use them for examinations of the systems they represent.

The Loud Sell: Television commercials tend to be, or at least seem to be, louder than the shows they interrupt. Is it true that commercials are louder? Ask students to find out. Furthermore, ask them to rate the loudest commercial in any night's viewing. (A tape recorder with a fairly sensitive noise level indicator might provide an objective source of information, but most students don't own one. If a handful of students listening to the same channel agree one way or the other, that is evidence enough.)

Timber!!!: Just for fun, crank up the time-worn argument about whether a giant tree falling in the forest makes a noise if there is no one there to hear it. To provoke a sure-fire response, don't put it as a question, but as a firm assertion: A tree falling in the forest makes no noise if....

Noise and Urban Planning: Have Students pinpoint those areas of the community where the most intensive noise levels prevail. First, identify the noise inputs, then the systems they represent. Next, students should appraise the make-up of the neighborhood immediately surrounding the epicenter of the noise (if it can be located that exactly) in terms of types of businesses, housing, parks, playgrounds, etc. Does there seem to be a planned and sensible marriage of noise to neighborhood? Are heavy industry, truck routes, railroads, and airports, for example, located well away from residential, medical, academic, and recreation centers? Or is the arrangement haphazard, reflecting a lack of planning? Are those residential neighborhoods near noise centers rundown? Why? Which came first in high noise areas, private homes or noise sources? What alternatives might have been exercised? What alternatives remain feasible?

One Person's Sound is Another Person's Noise

Sounds and noises are not the same for all people. Often cultural background, temperment, health, etc., determine sounds as sounds for certain people, while for others they remain annoying noises. Students can be made aware of this through role-playing. Describe a sound/noise, such as the roar of fans at a football game. Then ask two students, one of whom is to role-play a fan while the other plays the part of a local homeowner, to describe their reactions to what they hear. Other examples are the sound of a jet taking off as heard by airport officials and the airline's owners; demolition of a building witnessed by the contractor and the executive across the street; and the reactions of an American Tourist and a local native to a plaintive (and wailing) Mediterranean shepherd's song. Actual tape recordings can add quite a bit of "life" to these activities.

GROUP AND INDIVIDUAL PROJECTS

1. Have a student or small group investigate and report on anti-noise regulations on federal, state, and local levels. This might include interviews with area plant managers, airport personnel, and police.

2. The Concorde issue is another topic for investigation. Newspapers, weekly news magazines, area lawmakers, and environmentalists will have information on this subject.

3. The school science lab will have equipment for demonstrating the physics of sound. One or two students could put together an interesting demonstration of the nature and measurement of noise.

4. Some schools have eliminated buzzers and bells. The reason is that these signals are taken by students to be symbols of an authoritarian system. One or more students might conduct a poll of classmates, teachers, and administrators to determine various attitudes about the buzzer system as an annoyance, a symbol of regimentation, a necessary evil, or whatever.

UNIT 3: ON YOUR OWN

This is a simulation of sorts. It involves working with systems -- actually producing them. It also involves learning how humans shape the natural environment -- even when one person lives alone on a virgin piece of land. By devising and projecting the consequences of plans that will enable them to subsist for a year by themselves, students will become acutely aware of the interdependence and complexity in even a relatively simple system. If a student is shrewd and creative, he or she will get through the rigors and challenges this simulation presents. If not, the experience will be just as valuable for the student who can learn through relative failures that when one system breaks down, other interdependent systems suffer as a result.

The unit has been designed to permit maximum flexibility for students and teacher. In fact there are not nearly enough rules and guidelines to make this a game in the strict sense of the term. This is not wholly a matter of intent, as you will realize early in the unit. To anticipate, and attempt to impose controls on the vast range of choices open to each student who embarks on this adventure, would be impossible. To score numerically the value of each system a student creates, as well as the overall plan would be like giving one score to blue-eyed kids and another to brown-eyed ones. Evaluation, if you sense that any is necessary, must be subjective to a great degree. (More on evaluation later.)

Where this unit has been used, it has generated much enthusiasm in students, regardless of academic ability. In a way, the experience provides a fantasy fulfillment. Many kids dream in romantic ways about a Waldenesque existence, free from strife and complications. In this experience, however, Walden often gives way to the realistic, busy struggle to make it through the year. As in a game of chess, where the placement of a pawn early in the game will prove decisive many moves later, so may a student's choice from among many seemingly innocuous alternatives prove significant many intervals later.

GOALS

1. To apply their knowledge of systems and interdependence to a simulated activity of subsisting on their own.

2. To hypothesize about the consequences of decisions they make to insure their survival.

3. To demonstrate increased awareness of human-environment interactions in the simulated setting.

4. To demonstrate awareness that creating a change in an ecosystem can have far-reaching consequences.

5. To compare alternative plans in terms of their success and their impact on ecosystems.

TIME

We suggest that you allow at least a week for this simulation. Two weeks would be even better, if you can afford it.

MATERIALS

You will need only those materials included here, but two other basic items for classroom reference will be extremely useful. These are copies of the Sears and Montgomery Ward catalogs, including available farm supplements. They needn't be current, but should not be so old that their prices are no longer realistic. Student materials (pp. 27-31) will need to be duplicated.

INTRODUCTION

As a preliminary, there should be some discussion of the kinds of systems essential to pioneer life on the frontier 150 years ago. It is important that students rid themselves of any misconceptions about it being an easy life. One way to get at this is to ask them to list the systems that the pioneer had to create, and then to compare them with the systems we are provided with today. What kinds of community systems do we rely on? How did the pioneer substitute for these systems? Was life easier, less complicated for him or for us? If students can perceive in a fundamental way the interdependent networks of systems that they and their pioneer ancestors counted on, they are ready for the simulation.

THE GAME

In this simulation students, working individually, are to try to live by themselves for one year. They are setting themselves up in the present so they have access to more conveniences and research resources than 150 years ago, but the situation is not all that different. They have four months to establish the systems necessary to carry them through the winter. To begin they will be given land, tools, clothing, and a limited amount of money. (See details, student p. 27.)

That is all. Some "do nots" will keep the activities closer to subsistence. Do not let students make exceptions. They will try. Do not let them get away with absurdly inexpensive purchases. Do not let them tell you that they have an uncle who would give them a shotgun or a keg of nails, or anything else. Do not let them tell you that they went to

the dump and found a washtub. Do not let them hunt, fish, or trap out of season. (A simplified set of game laws is provided [p. 27]. Although these vary from state to state, it is easier to follow those included here.)

If you have Sears and Montgomery Ward catalogs, you can impose another restriction: Limit their purchases, aside from livestock, vehicle, fuel, some building materials, and incidentals, to items listed in the catalogs. You can permit them to buy used items, based on 60 percent of the catalog prices. But we suggest that you don't let them buy everything used. Furthermore, do not let them rent anything. Some price guidelines are included with the students' materials (p. 28), but not nearly enough to cover all needs. You will have to field many questions about the cost of this and that. It is a good idea to jot down what you have told one student about the price of a particular item. Someone else is bound to ask about the same item at a later date. (If you let them challenge you, you will waste a lot of time arguing about these prices. Don't.)

OTHER REGULATIONS

Students have from May 15 to September 15 to set themselves up for the rest of the year. By mid-September, all systems must be "Go," except for hunting and trapping. (During this period they may not work more than 70 hours a week. They may not live in a cave, dug-out, lean-to, tent, or hollow tree, except while they are building a permanent dwelling to be completed prior to September 15.)

Students should not be told what systems to devise. You may want to rate any overall plan a failure, however, if the individual has not set up the following in some detail:

1. A food system, including planting, weeding, harvesting (fishing, hunting and trapping are options); food storage, including canning, drying, salting, smoking, possible construction of root cellar; provision for sheltering and feeding of any livestock, etc.

2. Sanitation and personal hygiene systems, which must include a human waste removal system, organic and inorganic trash removal systems, a bathing-washing system, a clothes and utensils washing system.

3. A shelter, which could involve a cabin, yurt, dome, shanty, or other form of permanent dwelling.

4. A transportation system.

5. A water use system which keeps pond and stream pure.

6. A heating system.

All systems should be relatively efficient.

Students must live alone. They may not have friends and relatives drop in to lend free help.

Students must do their best to incorporate into all systems a respect for the land and the existing ecosystems it represents. This should be a significant factor in any evaluation.

Students must keep an accurate journal of progess and expenses from May 15 to September 15. A form has been provided (p. 30).

Students must indicate on the map all alterations to, and structures on, the land including garbage pit, incinerator, waterpiping, dwelling, root cellar, animal enclosures, outhouse, equipment shed, etc. They should also locate the garden and indicate its approximate size. (The map is to exact scale.) All fences, walls and roads should also be included. (The property borders an improved road along the west boundary.)

WHAT THE STUDENT ACTUALLY DOES

Provide each student with a map, cost sheet, journal sheets, and regulations. Explain that, using imagination and classroom resources, they are to begin setting themselves up, keeping an accurate journal as they go along. When they have plotted their way to September 15, they must add up all expenses and see how much they have left to last them through May 14 of the following spring. The weekly journal can be stopped at this point, but students should draw up a summary sheet explaining what systems they have set up and how those systems have been used to carry them through the balance of their year in the woods. This may sound very simple, but is not. If they attack this with vigor and intelligence, they will soon find themselves confronted with dozens of important and far-reaching decisions.

Encourage each student to explore the consequences of each decision made. For example, something has to be done about garbage and human waste. What system can be devised which will not result in land or water pollution. If a garden is planned, what will be planted and why? If farm animals are purchased, which ones were chosen and for what purposes? They will be making guesses here, usually based on little or no information. The debriefing and evaluation will indicate why some choices were wiser than others.

Some students will want to find out more about what foods to grow. Research beyond the catalogues available is entirely up to your discretion and to the time limits of the simulation -- obviously, the more research time allowed, the longer the simulation will last.

DEBRIEFING AND EVALUATION

There are no winners and losers in this simulation. One can "win" only by surviving better than someone else, and it is impossible to make clear-cut judgments about this in most cases. One "loses" if his systems do not carry him through. But it isn't easy to determine this either. The simulation has served an important purpose if students begin to sense relationships they hadn't previously known.

Here the teacher plays an important role. He or she should point out to individual students the implications of choices they may have made. For example, many students will decide to buy a cow, a seemingly sensible purchase. A cow gives milk, which can be drunk and also converted to butter and cheese. Or the animal can be slaughtered for meat. A cow is a very foolish purchase, under the circumstances. One cannot consume more than 15 percent of the milk even an inferior milker gives. A cow must be milked twice a day when in her most productive cycle. This means that the student must be on his land seven days a week. Making butter and cheese is a lot of work, and these products are hard to store. Cows consume too much grain. They must be fenced in, and will over-browse the land, muddy the pond, and get in the garden. If a cow is butchered it will yield much more meat than the student can store, or even consume in a year. Better to trade the cow for a handful of magic beans! A goat makes much more sense. Its milk is richer and yields less. They are great foragers and can actually help to clear out sections of brush where staked out. The meat of their offspring (kids) is good eating and matures fast. Pigs and sheep are not worth considering. A horse is a very poor investment. Chickens are a good deal. They're inexpensive to feed, lay eggs, and are old enough to eat at three or four months. Their manure is great fertilizer. Still, they have to be housed and penned at least part of the time, and chicken is a relatively cheap buy at the supermarket.

The student who buys a motorcycle has made a serious mistake. He can haul nothing in it -- and he has to do a lot of hauling. Furthermore, motorcycles are not useful when the temperature drops or when there is snow and ice. A used truck is the best bet. It's cheap, sturdy, and good for hauling. A jeep isn't really necessary. The public road is plowed in the winter.

Some kids will build a fireplace for cooking and heating. That's not a good idea. Fireplaces are very difficult to build, they throw relatively little heat, and are difficult to cook in. A small wood stove is best. They're inexpensive, relatively efficient, and the fuel is free for the cutting.

A shotgun is a wiser buy than a rifle because it can be used for large and small game. Log cabins are part of our heritage and are pretty to look at. They're also devilishly hard to erect by oneself. A yurt (read up on them) is a cinch by comparison, and is just as cozy and rugged as a cabin. Compare the two-week span for building a 20 foot yurt with ten weeks or so of back-breaking labor to erect a cabin. And so on. The object here is not to teach students about cows or yurts: it is to teach them to think in terms of the relationships of systems.

FOLLOW-UP ACTIVITIES

Ask students what they have been able to do about providing for the next year. How about the trappers in the group? Do they realize that to make $400-500 on skins they must invest over $200 in traps and related equipment; and must put in an average of three hours a day during the season? Bee-keeping might be more sensible. Honey can be sold for 50 cents a pound, and a good hive yields 60-70 pounds a year and requires little upkeep. Eight hives can be set up for about the same cost as the traps, and will produce for years.

Select a student panel to review and critique students' individual plans. Or divide the class into groups of four or five to discuss their findings and come up with a master plan.

Post the maps on the bulletin board and let the class comment on good and bad features. (Did anyone notice that only three students out of the entire class had sense enough to fence in the garden? And half the dwellings are completely in the open, where they'll be subjected to winter winds and the direct rays of the sun in summer. Etc.)

Have students list or submit for discussion the drawbacks of the life-styles they created. Which systems were the biggest problems? Which were the most enjoyable? Which cost the most?

Also have them consider which of their decisions led to the greatest damage to pre-existing ecosystems.

Finally, would they really like to do it? Would they stick out the year and maybe hang in for another year?

OPTIONAL ACTIVITIES

Art and English can be combined in this project, depending on coordination with teachers of those subjects and the interest level of the students. In English classes, for example, students might expand their journals to write about the events of a week or a month. These can include detailed accounts of daily activities or they might concentrate on applying their imaginations to such ideas as -- the feelings of being alone; being close to nature; the triumphs and hardships of being "on your own."

Some students may want to present an artistic perspective on their experiences. This could involve sketches or a painting of the environment which they have altered -- structures, garden, animals, etc.

ADDITIONAL SOURCES OF PRINTED INFORMATION

1. *How to Stay Alive in the Woods*, by Angier, Bradford. Collier-MacMillan Ltd., 1956.

2. *Foxfire Book, Foxfire 2, Foxfire 3*, Eliot Wigginton (ed.). Anchor Books, Doubleday & Co., Inc.

3. *Whole Earth Catalogs*, distributed by Penguin Books, Inc.

4. Seed catalogs:

W. Atlee Burpee Co.
300 Park Avenue
Warminster, PA 18991

Stokes Seed, Inc.
Box 15
Ellicott St. Station
Buffalo, NY 14205

5. Government offices and other organizations:

U.S. Dept. of Agriculture, Publications Division
Government Printing Office catalog of publications
State Dept. of Agriculture
State Conservation Dept.
Cooperative Extension Services
Future Farmers of America, nearest chapter
4-H Club, nearest chapter

GIVENS

You start the game with:

- Five acres of land, on which an annual tax of $50 has been paid. The property is hilly, and is 1800 feet above sea level. It is located in the Northern Temperate Zone and has a 4-season climate with a fairly harsh winter. (Temperatures often drop to subzero.) The land has a stream five feet wide and a pond 80 feet across. Each contains pure water and a small number of fish. Half the property is covered with mixed hard and softwood trees, the remainder being open field. The property borders an improved road along the west boundary.

  The surrounding land is partly wooded, partly open fields. It may be used for gathering wild foods, trapping and hunting, and collecting firewood. It may not be farmed or used for pasturing animals. No live trees are to be cut.

  The five acres are five miles from the nearest village (200 pop.) and 15 miles away from the nearest town (4000 pop.). The nearest source of electric power is over a mile away, too far to be tapped.

- Fifteen hundred dollars, on which you must live for a year. Out of this money, all purchases must be made, including building supplies.

- A complete set of hand and garden tools.

- An adequate supply of clothing for all seasons.

Other Regulations: You have from May 15 to September 15 to set yourselves up for the rest of the year. By mid-September, all systems must be "go," except for hunting and trapping. (During this period you may not work more than 70 hours a week. You may not live in a cave, dug-out, lean-to, tent, or hollow tree, except while you are building a permanent dwelling to be completed prior to September 15.)

You must live alone. You may not have friends and relatives drop in to lend free help.

You must do your best to incorporate into all systems a respect for the land and the existing ecosystems it represents.

You must keep an accurate journal of progress and expenses from May 15 to September 15.

You must indicate on the map all alterations to, and structures on, the land. You should also locate the garden and indicate its approximate size.

GAME LAWS

Hunting

Big game: Deer -- limit 1 per calendar year, buck only. Nov. 15 - Dec. 12.

Bear -- closed season.

Small game: ruffed grouse, quail, pheasant, squirrel, cottontail -- daily limit 4. Oct. 1 - Feb. 28.

Trapping

(Traps must be checked every 24 hours.)

Beaver, mink, muskrat, raccoon, skunk, otter, gray and red fox. Nov. 30 - March 15.

Fishing

Season is open from April 15 - Sept. 30.

COST SHEET

Livestock

Milk cow, vintage	200
Calf, 1 week old.	25
Horse	250
Goat, a doe (female).	40
Pig, 4 weeks old.	25
Lamb, 2 months old	40
Chickens, 3 months old.	2
(Chicks are listed in catalogs, as are ducks, geese, turkeys, bees.)	

Vehicles

Pick-up truck, 12 years old	200
Jeep or other 4-wheel drive vehicle, 10 years old	500
Snowmobile, 3 years old	200
Motorcycle	300
Bicycle, 10 speed, 2 years old.	65

Building supplies

Plywood, 4' x 8' sheets, exterior grade.	6
2" x 4"'s, 8 feet long	1
Nails, any kind, per pound	.50
Concrete blocks, each.	.50
Planks, estimate per board foot.	.70
(Most other building supplies are listed in catalogs.)	

Miscellaneous

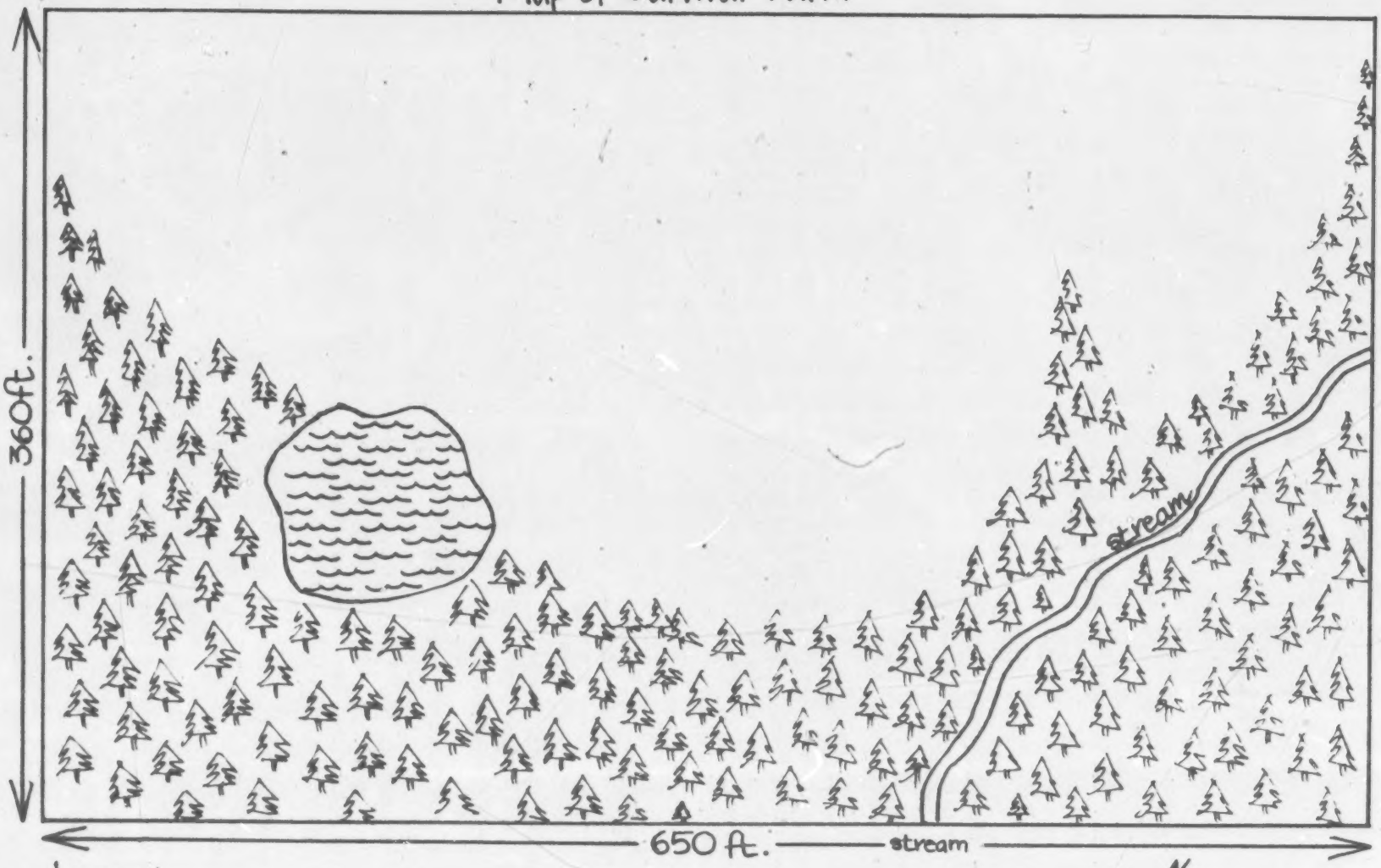
Trapping, hunting, fishing licences, each.	5
Hired labor, per hour.	3
Gasoline, per gallon	.60
Kerosene, per gallon	.50
Registration and insurance fees for vehicle, low average	100
Cost of farmer and tractor to plow and rake garden plot	30
Grain for animals, 100 pound bag (Consumed at a rate of ½ pound per day per animal.).	9
Hay, baled, per bale (Allow ½ bale per day per animal from October 15 to May 15.).	1

JOURNAL SHEET

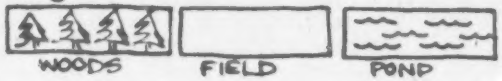
week of _____ 19___

Accomplishments	Expenses	
	Item	Cost
		$
	Total Expenses	$_____

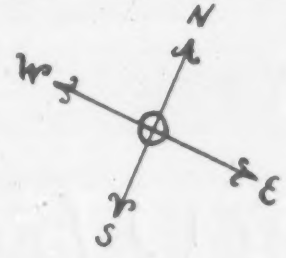
Map of Survival Farm



Legend



.015 inches = 1 foot
43,560 sq. ft. = 1 acre



UNIT 4: THE MILLIONAIRE WHO EARNS LESS THAN YOU WILL

GOAL

To apply knowledge of systems and interdependence to analyze environmental issues and the interaction of humans and their environment.

INTRODUCTION

Of the four units in this handbook, this is the most difficult. The concepts are here, but they are not presented in simple ways. To get at the kinds of understandings the unit offers, students will have to dig and interpret. Essentially, this is an economics approach to the study of systems, and economics is not an easy subject.

The following scenario deals with a Kansas farmer. It attempts to be accurate, if brief and over-simplified. But it is purposely sympathetic; Stanley Hoenenburg is a reflection of how farmers like to see themselves. His points of view are those of a farmer, not a detached reporter. Students should begin to realize that information is rarely without slant; and part of this unit's value can be in the form of a revelation about this truth.

Furthermore, the scenario is journalistic, not pedagogical. It is the kind of reading one would expect to find in a magazine, not a textbook. No attempt is made to define terms that might not be included in a student's working vocabulary. Terms like *cost accountant, market analyst, economist, purchasing agent, staples, guaranteed income, wholesale and retail, rising market,* and *credit agencies* should be defined beforehand if there is doubt that students are familiar with them.

The unit also pretends to presume that the students are familiar not only with systems and interdependence on a multi-national level, but also with recent and current issues such as inflation, the crisis stemming from the hike in Arab oil prices, and the controversy and temporary embargo connected with the sale of wheat to Russia. These too should be discussed, unless they have already been covered.

The suggested activities following the reading vary in difficulty. All of them are within the ability of well motivated freshmen, but they can be adjusted to suit students of lesser ability. The "cow" exercise is fun as it is; almost any student can work it out with relatively little effort. The loaf of bread diagram is presented as raw data. It is meant to be interpreted and analyzed without additional information beyond that implicit in the overall unit. The "Debates with Stanley" are potentially sophisticated issues, but they can also be profitably discussed at a simple level quite suitable for upper junior high students. (Except for the "cow" assignment and perhaps a bit of simplistic exploration of the loaf of bread diagram, seventh graders won't take to this unit at all.)

STANLEY HOENENBURG, MILLIONAIRE

You have never heard of Stanley Hoenenburg, millionaire. His name is never in the papers. He does not drive a Rolls Royce or even a cadillac. He does not own a yacht or belong to a swanky country club. He has never traveled abroad or taken a vacation at a resort. He does not contribute large amounts to charity, and no one expects him to. His home is no different, no fancier, than most houses in most towns. He is not the inventor of a successful product, nor did he discover oil, gold, or any other valuable mineral on his property. He has not made a killing in the stock market. He is not an executive officer in any corporation.

Stanley Hoenenburg is a farmer. When you buy a loaf of bread or a piece of steak, some of what you pay finds its way back to Stanley and to thousands of other farmers like him. According to them, what comes back is not enough.

There have been Hoenenburgs farming in Kansas since before it was a state. Stanley was born in the house he and his wife live in today. His younger son, Ted, attends Kansas State University, majoring in agriculture. His older son, Bill, is a teacher. One day, Ted will take over the farm. It will be different in many ways from the spread his father remembers from early childhood. Then it was under 300 acres. Now it is close to 3000 acres, not including an additional 2200 acres which Stanley leases. Many U.S. cities are contained in less than 5000 acres, but the Hoenenburg farm is not considered huge by Kansas standards.

Stanley looks back with mixed feelings to a time when farming was simpler, not so much a business as a way of living. Today it is a highly complex business. Hoenenburg is not just a farmer, in the earlier, simpler sense of the word. He is an employer with four year-long employees and an additional 40 at peak times of the year. He is a machinery and equipment maintenance manager; a cost accountant of sorts; a market analyst and economist; a purchasing agent and salesman; a credit expert; a cool-headed gambler; and a man who knows when, and how deep, to plant a seed to make it grow. To be all these things, Stanley Hoenenburg works about 80 hours a week on the average. Also, on the average, he earns less than $4 an hour, much less than the wages he paid out to the carpenters who built an addition on his house last summer.

To be sure, Stanley's real worth is not reflected accurately in that figure. For one thing, he figures Mrs. Hoenenburg's "salary" into his computations. But because she takes care of many farm-related jobs, including the bookwork, this is fair enough. Then too, the farm provides most of the family's food staples; and insurance, home heating fuel, transportation, home upkeep, work clothes, even seeds for Mrs. Hoenenburg's flower garden are charged to farm operating expenses. Still, if one doubles or even quadruples this figure, it comes out to less than what the average middle level executive earns. And most executives, Stanley feels, know less and don't work as hard as he does.

It isn't what a white collar worker earns by comparison, however, that bothers him. It is that what Stanley ends up earning depends on matters outside his control. He does not have a guaranteed income -- far from it. By working twice as hard he could earn less, or nothing at all. Or he could lose.

For example, because Arab nations boosted the price of oil, fertilizer (a petroleum product) jumped four times in cost. This has had a serious effect on farm earnings. The Hoenenburg farm raises five crops, all of which use fertilizer. One crop is wheat; the other four are various cattle feeds, including hay. The farm counts on the sale of beef for about 70 percent of its income, on wheat for the balance. But the price paid to farmers for beef by wholesale meat buyers hasn't climbed as fast as the increased cost of raising beef cattle. A recent dip brought the price so low that farmers lost an average of ten cents a pound on every animal they sold. Increased fertilizer cost figured into that loss.

If feed costs more to grow, it also costs more to buy. A longer than average winter forced the Hoenenburgs to purchase additional feed for their herd. Along with the increased price of fertilizer, the 50 percent hike in the cost of diesel fuel and gasoline for running the various types of farm machinery hurt farmer and feed dealer alike.

Approximately 1400 miles from the Hoenenburg farm, but directly connected with it in many ways, a Boston supermarket was forced to hike its food prices up another percentage point. The supermarket had to cover the jump in the price of heating fuel, which rose close to 100 percent in less than two years. This is part of the reason why farmers like Stanley are upset. If it costs the consumer more to buy beef in the market, why doesn't the farmer get his share of that additional three or more cents a pound charged for your sirloin? Stanley has figures to prove that nearly everybody else does, right down the line to the Hoenenburg's front gate. He could share in it too, he thinks, if he and his fellow farmers formed a big, tough union. (Imagine the effects on the entire world if a nationwide strike choked off the flow of beef -- or any other vital food -- to the marketplace!)

But farmers are very independent people, and most of them resist the idea of unionizing or even forming corporations. Because of this, they do not have as much influence on prices as the truckers who bring their beef to market, the large corporations which sell it, or the many other organizations that figure in what it costs you to eat. Each of these organizations must make a profit to stay in business. As their costs of operation go up, so must the prices they charge.

A farmer cannot operate this way. He, unlike other businesses, does not set the price for his goods. If he attempted to sell his cattle for a half-cent more per pound than the current going price, he would probably not be able to sell them at all. Why? Because many other farmers would settle for that going price. Either that or take their stock off the market, continue to feed it, and increase their cost per pound even more while waiting for a rise in price. Few farmers can afford to do that.

When a major oil company, or supermarket chain, or chemical supply corporation, raises its prices, it does so in the near-certainty that its competitors will be forced to do the same. A farmer has no such guarantee. He must settle for what the market is prepared to pay. If he gives his employees a raise, he has no guarantee that other farmers will do the same. There is no strong farm employees' union to force them to. Thus, he may end up being the only one to absorb that extra operating cost. If he develops a better but more expensive diet for his cattle, he does not know that he will be able to sell his improved beef for any more per pound than before. If he is a shrewd bargainer, he may be able to squeeze a bit more from the cattle buyer, but this is only because he is shrewd, not because he is forcing beef prices up.

If he is a gambler, he may wait for a rising market. Or sell his herd piecemeal over a stretch instead of all at once. If he is able to coax more corn per acre from his land, he'll earn a few dollars more because he'll spend a few dollars less on feed. The trouble with farming, starting with the weather itself, is that it is full of such *if's*.

An early hard frost or a long dry spell could send Stanley Hoenenburg deep into debt. Not that he is ever out of debt. No farmer is. They rely on credit and pay back most of their year's earnings to farm credit agencies, along with interest on their loans. After a bad year they must borrow even more, just to prepare for the coming year, which may also be bad. That is why Stanley doesn't appreciate being called a millionaire. True, his land, buildings, stock and equipment are worth that today, but the Hoenenburgs have little cash and are heavily in debt. Unlike the fortunate people we think of when we hear the term "millionaire," Stanley belongs to a hardworking, sunburned class of millionaires who make less than $4 an hour.

The modern farm is a collection of systems. Many students don't realize this, and entertain fuzzy notions at best about what a farmer does besides plant seeds and harvest the crops that grow from the seeds. The foregoing scenario provided a brief look into only some of the systems that farming involves. The problem, in fact, is that if one begins investigating farming from a systems-subsystems approach, the ways are endless and myriad. The concept of interdependence is easily delineated, and the multi-national implications are in obvious evidence. In short, there may be too many things to consider. We therefore suggest tackling only some of the following possibilities, after allowing students to read copies of the scenario.

The Farm as a System of System Inputs

Depending on the size of the class, have students split into groups or work individually on this project: Each group (or student) is to represent one essential service or source of supply for the Hoenenburg farm. Because they will have to do some research to find out what each service and supply source represents, make this a long-range assignment -- perhaps a week or more. *This is not an easy assignment.* You can simplify it by reducing the list below, eliminating the more difficult ones and adding more students to the remaining groups. In any event, *these sources will need to be carefully explained beforehand.* Service and supply sources are:

- ***Fuels*** -- gasoline, diesel, home heating.
- ***Feeds and feed supplements*** -- vitamins, minerals, in addition to grain, corn, calf starter, etc.
- ***Farm equipment*** -- tractors, harvestors, trucks, other implements such as haybalers, cultivators, etc.
- ***Chemicals*** -- includes petrochemicals, other fertilizers, pesticides.
- ***Hardware*** -- from fence wire and bolts and nuts to heavy equipment parts.
- ***Communications*** -- radio reports about stock prices, futures, weather; computer data from regional data service regarding costs of operation, net average profits; newspapers, local, for advertising services and products new and used; newspapers, national, (*Wall Street Journal*) for agricultural trends, international information on possible overseas markets, etc.
- ***Money*** -- borrowed from the Farm Credit System, and repaid at interest comparable to bank interest.

Students should be able to explain, at least in simple terms, why each of these operations is vital to the farmer. They should also be asked to present a good argument for their having charged Stanley more and more over

the last few years. Here is where the systems concept begins to make itself evident to most students. Even on a surface level, the interacting forces that drive up the cost of barbed wire (which has risen by over 100 percent in two years) or a fan belt for a tractor, or the price of the *Wall Street Journal* (which many larger farmers read faithfully) are worth discussion and reflection.

Farm equipment catalogs from such companies as Massey-Ferguson, John Deere, International Harvester Farmall Division, and Ford Tractor are useful source materials and are fascinating in themselves. Sears and Montgomery Ward also have supplemental catalogs for the farmer. The *Wall Street Journal* offers information on the futures market, which, however, may be too complicated for most students to handle. Various agricultural magazines, too numerous to mention, contain useful information, but may be hard to locate except in farm country. Hardware dealers seem especially able and willing to go on at length about their sources of supply vis-a-vis the cost-price squeeze. Most area and local newspapers make a policy of cooperating with schools, and should be able to reveal how information gets from source to audience and why it now costs more to get it there. The same should hold for radio and TV stations.

Let's Play Beat-the-Supermarket

This is fun, especially for kids whose only notion about beef is that it comes wrapped in cellophane packages decorated with price stickers that the folks complain about. Each student gets to raise a calf from age two days to maturity (22 months). It isn't really considered beef much before that. A veal is a calf no older than six to seven months. After that it is considered to be baby beef, which Americans don't seem to like. So don't let your students try to cut corners and costs by trucking Elmer to the slaughterhouse before he's a full-grown steer. The costs listed below (see p. 38) are fairly accurate, if low, although a few may vary sharply from place to place. Unless the whole class agrees to change one, however, make all students use them as printed. Note that students *must* charge themselves labor. In our economy no one works for nothing. No job can be cost-accounted without wages being figured in, even if no money actually changes hands. The total bottom line cost per pound works out to $1.49.

What makes this more than a simple math problem is what comes next: Have each student work out with his parents as accurately as possible his family's average cost per pound for *beef*. If this is impossible, they should at least attempt to average the cost per pound of each type of meat consumed by the family. The figure will probably come out to less than the cost of home-raised beef. Be sure to stress that the computations must include the many cheaper cuts that are included in most families' diets.

Still another factor colors this computation: The family food storage system may include a home freezer. If it does not, freezer space will have to be rented or a freezer will have to be purchased. If a family does own

COSTS OF GETTING A CALF TO MARKET

A. Cost of raising calf to maturity

Price of healthy calf	$25
Cost of calf-starter	35
Cost of hay	150
Cost of grain	100
Cost of veterinary services	20
Cost of food supplements, vitamins, minerals, pesticides	25
Cost of trucking to butchering plant	15
Cost of your labor at current minimum agricultural wage of $1.75 x 125 hrs	____
Total pre-butchering costs	____ (A)

B. Figures and costs, butchering

Live weight at 22 months	900 pounds
Dressed hanging weight (carcass weight)	525 pounds
Butchered weight (trimmed, packages to order, includes ground and stew meat, liver, heart)	435 pounds
Cost of custom butchering per pound, based on carcass weight ($0.12 x 525)	____ (B)

Total costs of meat (add A and B) ____

Total cost per pound (divide total of A and B by 435) ____

a freezer, 400 pounds of beef will fill it to capacity. How many good buys of other foods in quantity will have to be passed up while that freezer remains crammed with beef?

Finally, consider and list the many reasons why the supermarket can sell meat as cheaply (or even cheaper) than we can raise it at home. (The costs-chart figures allow for 6 months of free grazing a year, so don't let students argue that they had to feed their cow hay all year.)

Debates with Stanley

Remember, these facts are from a farmer's point of view. They can, and should, be examined critically. There is much room for counter-argument, or at least a skeptical reservation about accepting his observations hook, line and sinker. These ideas need not be used as the basis for formal debate, although they could lend themselves to that. They are useful enough as fuel for discussion, research, or even lecture.

Stanley boils when the talk moves to the subject of government and the farmer. No other group of producers in this country is under the thumb of government as much as the farmer, he feels. When President Ford imposed an embargo on the shipment of wheat to Russia, Stanley almost lost his shirt. His entire wheat crop was scheduled to be shipped to the USSR, after a disastrous crop failure had created desperate shortages there. Until the President lifted the embargo, the Hoenenburg wheat sat in a grain elevator, while the U.S. price of wheat toppled. Had the embargo remained, the wheat would have been worth about what it cost to raise. Stanley thinks that American farmers should be able to sell their produce to the highest bidder, without having to wait for government approval. If the farmer can get more for his wheat in Turkey than in the U.S., he should be free to do so, even if it creates occasional shortages here.

On the subject of wheat, Stanley feels that most of the profit is going to the wrong people. (He feels that way about beef too, remember.) To even up the profit picture, it might not be a bad idea at that to form a hard-nosed organization representing American farmers. If the farmer in this country had as much influence in Congress as the big unions do, his thinking goes, things would get better in a hurry. The farmer would get a more reasonable share of the profit which begins with him.

Salami Sandwich, Please. Hold the Bread

The diagram below, while not entirely self-explanatory, offers enough information to form the basis for numerous questions and investigations regarding the interdependent systems involved in the creation and the ultimate price of a loaf of bread. The best way to approach this is also the easiest: Give a copy to each student and ask, What does this mean?

Consumer pays 38 cents per pound loaf of bread

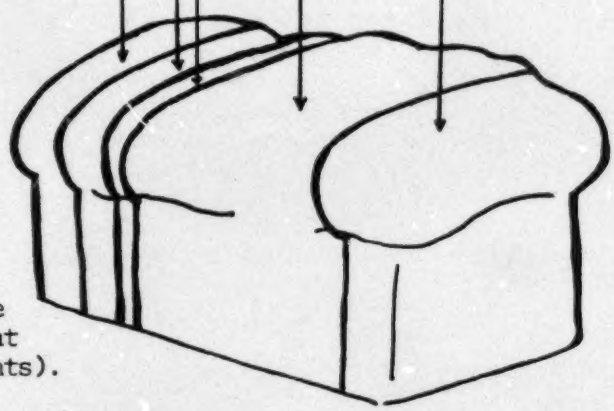
Farmer 4.7 cents
Seed, fertilizer, insecticide, taxes, insurance, labor, machinery, fuel, repairs, depreciation, profit margin

Elevator (storage) 3.3
Labor, fuel, taxes, building and machinery maintenance and depreciation, profit margin

Mill (grinding) 0.7
Machinery, labor, profit margin

Baker 23
Labor, packing, equipment, distribution, other ingredients, profit margin

Retail store 5.6
Overhead, labor, profit margin



A series of marketing processes increases the cost of a raw product at each step (shown in cents).

It goes from farmer to middleman to retailer to consumer. More than half the retail cost of a product often pays for something other than the food.

Source: San Francisco Chronicle and Examiner, 10/7/75, p. 11.

RESOURCES

Built Environment: A Teacher Introduction to Environmental Education. American Institute of Architects. 1975.

Proposed Humanities Framework for California Schools. Humanities Framework Committee. Sacramento, 1975.

You Are an Environment. Noel McInnis. Evanston, Illinois. The Center for Curriculum Design, 1972.

Teaching for Survival: A Handbook for Environmental Education. Mark Terry. Ballantine Books, 1971.

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AUTHORS

David C. King is principal writer and general editor for the Center for Global Perspectives' project, Population and Other Environmental Concerns: A Project for Developing Curriculum Guides and Handbooks Using Interdependence as an Organizing Concept. He is also co-director of the Center's project, Global Perspectives: A Humanistic Influence on the Curriculum. He has taught English and social studies and is the co-author of *Foundations of Sociology* (Holt, Rinehart and Winston) and of the fifth grade text in Houghton Mifflin's new social studies series, Windows on Our World.

Ann de la Sota, author of the K-3 Handbook, is a staff member of the Mankind Schools Project, Institute for the Development of Education Activities (I/D/E/A).

Cathryn J. Long, author of the 4-6 Handbook, is a writer on the Center for Global Perspectives' staff. She has taught English at the University of California, Berkeley where she is engaged in a doctoral program.

Peter R. Stillman, developer of the 7-9 Handbook materials, is a teacher at the Carlotte Valley Central School, Davenport, New York, and a free-lance writer.

Jayne Millar Wood, co-author of the 10-12 Handbook, is Director of Public Education for the Overseas Development Council.

EDITORS

Andrea B. Karls has taught elementary school and junior high social studies. She is on the staff of the Center for Global Perspectives and is Associate Editor of INTERCOM.

John Boeschen is a doctoral candidate in education at the University of California, Berkeley. He has taught science and is currently writing a science text for Harcourt, Brace, Jovanovich.